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PRACTICAL MECHANICS

NOVEMBER

6d.

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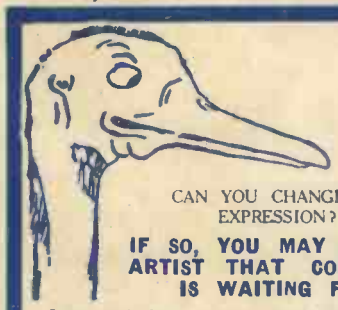

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PRACTICAL MECHANICS

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Fair Comment

By The Editor

The Unemployables

REMARKABLE as has been the recovery of this country from the economic stress in which it found itself when the War ended, there are still nearly 2,000,000 unemployed in this country. I observe that an effort is to be made to separate the *unemployables* from the unemployed, and thus to prevent a square peg being placed in a round hole to the detriment of the round pegs which would fit them. This is undoubtedly sound reasoning, for I refuse to believe that in these days of labour shortage anyone with ability to do a particular job is legitimately out of work. But I fear that much of the incentive to attain position has left us. The plan of the ambitious of former years to shun delights and live laborious days seems to have been subjugated to the needs of a weekly visit to the cinema, the dance hall, the skating rink, and the sports ground. More and more do we tend to rely upon some beneficent influence to settle conditions of labour for us so that we may work less and less for more and more until finally we shall do nothing for everything—rather on the lines of the definition of a good salesman who starts off by knowing nothing about everything, and goes on learning more and more about less and less, until finally he knows everything about nothing.

Mounting the Ladder

WE cannot deny there is less desire to-day than ever before to ascend the rungs of the ladder of fame. I do not necessarily subscribe to the sickly sentiments of the rhyming poets such as Longfellow and Tennyson nor with the trashy and sickly nonsense they churned out under the name of poetry. Most of it was insincere, and there is no room in my mind for the individuals whose thoughts are decided by the word which rhymes with that which terminates the preceding line. But I still do subscribe to the lines which say:

"The heights by great men reached and kept,
Were not attained by sudden flight,
But they while their companions slept,
Were toiling upwards in the night."

And:

"Lives of great men all remind us,
We can make our lives sublime,
And departing leave behind us,
Footprints on the sand of time."

Those are sententious rhymes, but I still subscribe to the rule that an individual can be within limits what he wants to be. Genius and ability do not connote merely the absorption of the world's heritage of knowledge. Anyone with a good memory can do that. It is the desire incessantly pursued towards a given goal that eventually lands the individual above his fellows.

The Perfect State

THE problem is what to do with the unemployables. It is right that scientific investigations should be made into their special problem as is now proposed, for science is entering into most things to-day. I do not believe in a lot of the modern black magic such as psycho-analysis and psycho-this and that, but I firmly believe that if we analyse the reason for too much unemployment at a time when so many opportunities exist we are on the high road to creating the perfect state.

There is too much belief in luck to-day. If two boys start dead level in the engineer's shop, and in five years' time one has attained to a better position than the other, the one in the lesser position will say that his co-apprentice is lucky. Luck does not enter into it. If it is possible to analyse the ergs of effort which each has put out, in the desire to establish a position and a reputation, we shall find that the so-called lucky one has forgone the counter-attractions with which our age is replete, and has plugged away at his own advancement, whilst his confrère has been enjoying himself. There is just as much ill luck as good luck and on balance they cancel out one another.

The unemployables are those undiscerning people who have grabbed at the shadow in the form of a lucrative job in a blind alley occupation rather than going for the substance which exists along the road. Nothing easily got was ever enduring. Easy come, easy go.

What is Wrong?

THE present position of the labour market is most disconcerting for firms are finding themselves having to bargain not only for the raw materials, but also for the labour necessary to work it. On the one hand you have a shortage of labour and on the other over 2,000,000 unemployed. What is wrong? Is it not that individuals are failing to make themselves qualified for the opportunities which exist? Is it not they fail to appreciate the marvels of the age in which we live and that their knowledge is not moving with the times? Surely that must be the answer, for you cannot have a shortage and a surfeit of the same thing at the same time. There is no excuse for lack of qualifications. Evening classes, correspondence courses, and education are all cheap. You have to make a small sacrifice of time in order to participate in the benefits which they confer. Those of you still in your teens who read these notes should not make the mistake which so many made ten years before you. If you do, and do not heed this warning, in ten years' time you will be sorted out from the employables. Above all, have a practical training. It is far better than a purely theoretical job. So many people imagine that money is made out of salesmanship, and it is because of this, that there is a shortage of those who make the things to sell. It is better to be a maker than to join one of the many parasitic jobs associated with the selling and marketing of goods.

Building the "LUTON MINOR" Light Aeroplane

PART II

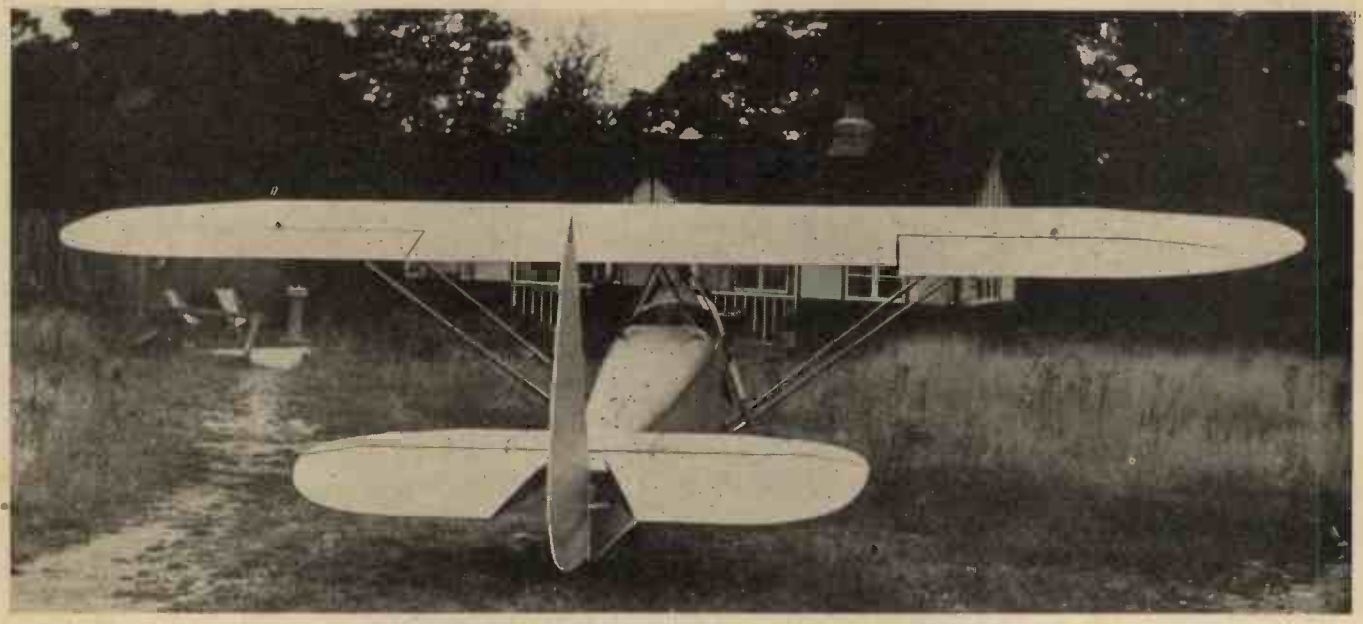


Fig. 1.—A rear view of the plane showing its attractive lines.

Assembling the Wing

OBTAIN two trestles, 2½ ft. to 3 ft. in height and 4 ft. or more long, and set these parallel about 12 ft. apart (or 6 ft. apart if the wing is being built in halves). Place the two main spars across the trestles, having first pencilled on them the positions of all ribs, i.e. 1 ft. spacings, and thread the ribs into position. The central 10 ribs have the small rear spar gap, but the outer ribs accommodate the aileron spars also. Thread the aileron spars into position also.

Cut the drag struts to the required length, 34½ in., there are 5 of these; one for the centre, and a pair 6¼ ft. to either side (see the general wing arrangement, Fig. 2). Cut 4 triangular biscuits of ⅛-in. ply for the end fixings of the central strut. These

Construction Described by The Designer

may be cut from 2 squares, 4 in. by 4 in. Attach, by glue and brads, one pair of these biscuits at each end of the strut, as shown in Fig. 3, and cut away small gaps, roughly ½ in. by ⅛ in. to accommodate the wire bracing fittings (Fig. 3).

The Drag Struts

The outer pairs of drag struts are faced on both ribs with ply sheets, 34·1 in. by 5 in. deep and so form hollow boxes, the ends having central cutaways ½ in. by $\frac{1}{10}$ in. as before.

The positions of all wing spar fittings will have been marked on the spars before assembly and the bolt holes may have been drilled. On the front spar, rear face (see page 9 of October issue of PRACTICAL MECHANICS) starting from the centre, there are fittings 6W and 1W on the centre line; the pulley bracket 8W, 13½ in. outboard; the pair of lift strut attachment fittings 2W, one on either face of the spar, set as shown in the diagram. The top bolt through these fittings takes also the drag bracing fitting 6W, and the upper parts of the flanges of 2W

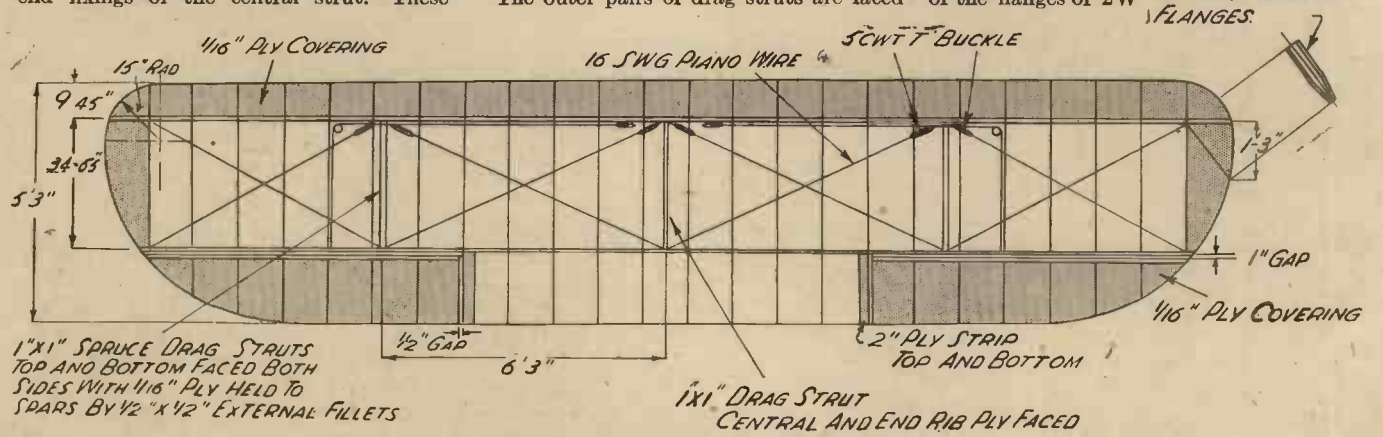


Fig. 2.—The general wing arrangement.

on the rear face may need slight filing to accommodate 6W. Just inboard of the 5th rib from the wing-tip are the two pulley fittings 5W, and at the end rib is the outer drag bracing lug 7W.

The Rear Spar

The rear spar has the pair of rear lift strut attachment fittings 2W, the three drag bracing fittings 7W and 6W (two) on the front face; the 3 hinge fittings 4W and the pylon attachment lug 1W on the rear face. Note that the flanges of 2W on the front face may need filing to take 6W, as explained for the front spar.

All the fittings mentioned above may be bolted to the main spars. No fittings should be attached to the aileron spars at this stage.

Now place the drag struts in position and attach the six turnbuckles, or strainers, to the lugs of fittings 6W and 7W at the front spar. Cut 8 lengths of 16 s.w.g. piano wire, about 7 ft. long and fit these to the lugs on the rear spar. To do this make a loop 3 or 4 inches from the end with the aid of a pair of bull-nosed or round-jawed pliers, and turn the short end parallel and close to the main wire. Engage the lug of the fitting and slip a ferrule over the double wire (Fig. 4). The ferrule may be of the standard made-up wire type, or it may be made of a ¼ in. length of steel tubing, preferably flattened to fit the two wires. Push the ferrule close to the loop, turn back the free end and cut off the surplus wire. Now make the loop at the forward end, by first slipping the ferrule on to the wire and engaging the eye of the turnbuckle end. Care must be taken to

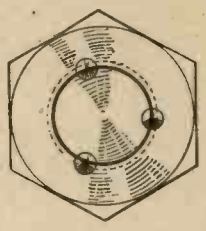


Fig. 8.—Locking the bolts with a centre punch.

obtain the correct length of wire and this may be done by screwing out the turnbuckle so that about ¼ in. only of each thread is engaged. When the wires are tensioned, which should be done altogether, or at least in pairs, see that each turnbuckle has sufficient thread engaged at both ends. Small holes are provided in the turnbuckle ends for the insertion of a thin wire or pin to ascertain whether the threads are "in safety."

A warning may be issued here against over-tensioning of the bracings which sets up initial stresses in the spars and other members. As a rough guide the turnbuckles should be turned until the wire just straightens out and another further half-turn may be given.

Tensioning the Wires

Just prior to tensioning the wires, fix the drag struts by gluing and bradding ½ in. by ½ in. spruce fillets external to the ply faces and to the spar (Fig. 3). Tension all wires and check for rigging by measuring from the centre of the front spar to points along the rear spar at the drag strut attachments. Note that the end or wing-tip ribs act as the outermost drag strut. Alignment of the spars should also be checked by looking along them from tip to tip.

The ribs may now be fixed in position. Slide each rib a little to one side, apply glue to both faces of the spar and return the rib to its correct location. Bring the ribs up so that the bottom flanges fit tightly to the under-surface of the spar. A few brass gimp pins should be hammered through the rib verticals, or soldiers, to complete the join to the spars. Similarly attach the aileron spars, making sure that the 1 in. gap is uniform at all points—this may be facilitated by inserting pieces of

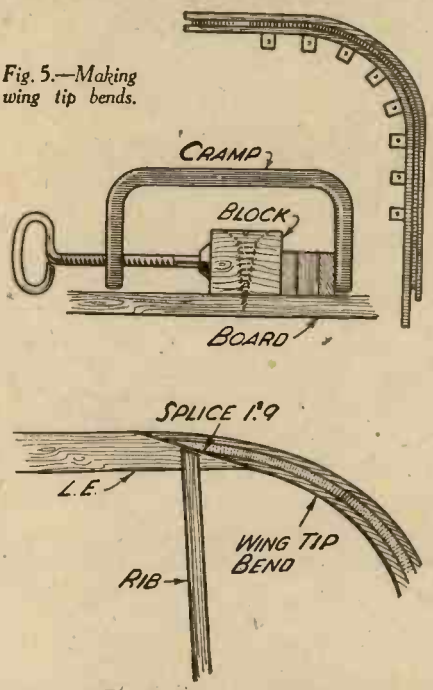


Fig. 5.—Making wing tip bends.

Fig. 6.—The wing tip splice.

wood 1 in. in thickness between the aileron and rear spar.

Next make the wing-tip bends. These are made up in two segments, the division being at the front main spar. The forward segment of small radius (15 in.) is made from 3 laminations of ½ in. by $\frac{3}{16}$ in. ash, the rear segment consisting of 3 laminations of ½ in. by $\frac{3}{16}$ in. spruce.

Fig. 7.—Constructional details of the tail plane.

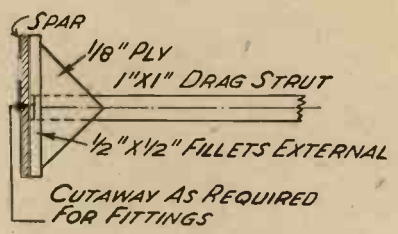


Fig. 3.—Details of the centre drag strut.

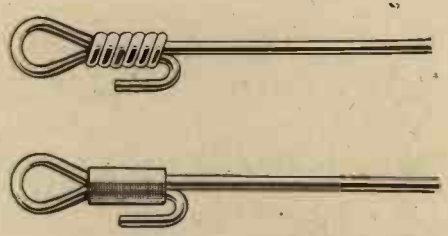


Fig. 4.—Loop ends of wire along bracing.

Making the Bends

To make the bends, set out both shapes on a board and screw a number of blocks to the inside contour. The laminations are glued and cramped to the blocks by means of small cramps. Leave until dry to set.

The leading-edge and trailing edge members are next fitted. The slots in the ribs will require some cleaning up to house these and lengths of cotton should be stretched across the span at the front and rear to ensure that all slots are in line. Any necessary adjustment should be made by cutting away the ribs.

Place the leading edge member (½ in. by ⅜ in. spruce) in the slots, glue to the small vertical members in the ribs and fix with one ¾ in. brass gimp pin through the leading edge into each vertical. The trailing edge member (1 in. by ¼ in.) is similarly placed and glued into position and may be held by one small ⅜ in. gimp through each rib flange at the rear. If desired the joints may be further finished off by means of small semi-circular, or triangular, ply biscuits, fixed to the trailing edge and bottom rib flange.

Leading and Trailing Edges

Next cut the leading and trailing edge members ready for splicing. This should be done at a rib, the angle being roughly 1 in 9 (see Fig. 6). The rear segment is first fitted and in turn is scarfed at the front spar for receiving the front tip bend. Finally the front bend is cut to suit the leading-edge and rear bend scarfs and is glued in position. The front and rear splices may be made good by means of 2 or 3, ¾ No. 4 screws and one screw may be driven through the central scarf into the front spar.

Further shaping of the wing-tip bend

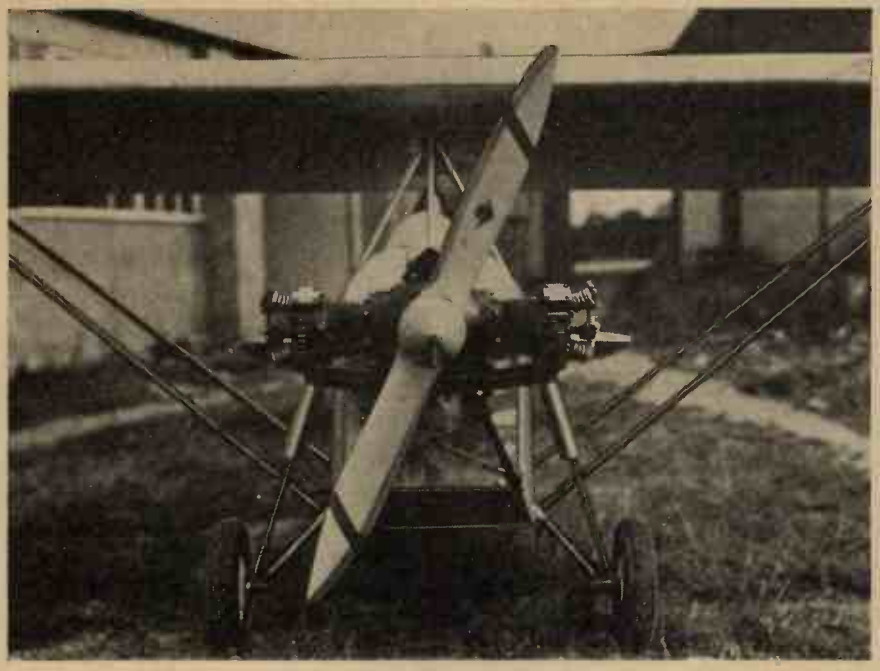


Fig. 9.—A part-front view of the plane.

may now be done, the depth being carefully graded to merge into the thickness of the front and rear edge members.

We are now ready for attachment of the leading-edge nosing ply, but it is as well first to lock all bolts in the front spar. This is done by cutting the bolt (if necessary) almost flush with the nut and, with the aid of hammer and centre pop, making three centre pop marks round the thread, as shown in Fig. 8. Now run a length of $\frac{3}{8}$ in. by $\frac{1}{2}$ in. spruce along the gap above the front spar (Fig. 13), and fix to all ribs on the under-rib of the top rib flanges. This is for supporting the nosing ply. Strips of spruce, approximately $\frac{1}{4}$ in. by $\frac{3}{16}$ in. are then glued and tacked between all ribs, to the bottom face of the front spar and on the upper face of the $\frac{1}{2}$ in. by $\frac{3}{16}$ in. runner just fitted.

Before attaching the ply it is as well to take a straight edge, about 4 to 6 ft. in length, and to hold this against the rib profiles in the vicinity of the leading edge, both above and below, to test for uniformity of contour. This should be done over the whole span and if there are any "high spots" the ribs should be cleaned down accordingly, or a little packing out may be done to ensure the correct shape along the span.

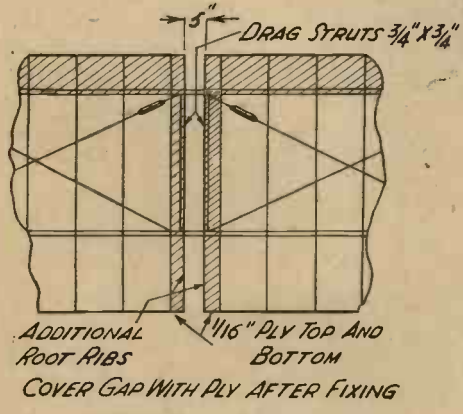


Fig. 10.—A plan of the wing centre.

Fig. 11.—A scarfed joint in the plywood.

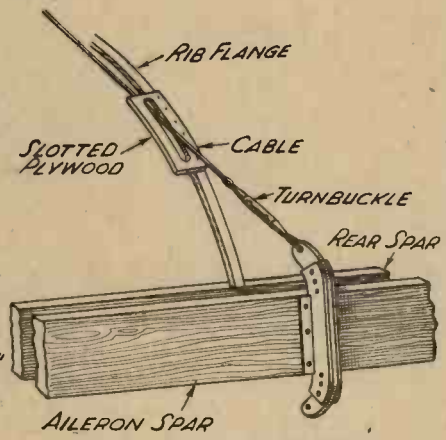


Fig. 12.—The cable entry to the wing.

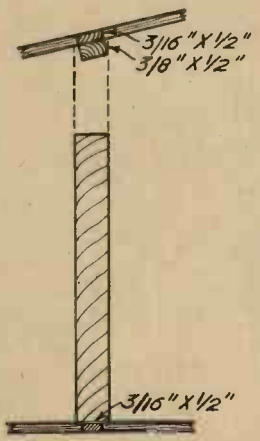


Fig. 13.—Details of the front spar.

The Nosing Ply

The nosing ply may be fitted in separate lengths, or preferably in one piece over the 17 ft. parallel portion of the span. If it is to be fitted in one length, first cut a sufficient number of $\frac{1}{16}$ in. ply sheets to make a 17 ft. length. The necessary width may be found by measuring round a rib from the rear face of the front spar at the top to the rear face at the bottom. It is 22½ inches. These pieces are then scarfed together as follows: Place a sheet of ply on a bench with a reasonably clean, sharp edge, bringing the edge of the ply flush with the bench edge. Then shoot with a plane held with a slight outward tilt so that the ply is given a feather edge, the tapering part being roughly 15 times the ply thickness, or in this case about 1 in. Repeat at the opposite edge but with the scarf in the opposite face. The joint is made by bringing two of the scarfed faces together (Fig. 11) and gluing. A wood strip should be tacked along the outer face, the tacks passing through to the bench or to another strip below. Strips of paper may be inserted between the wood strips and ply to prevent the glue from fixing them together. Remove wood and paper strip when the glue is set.

Curving the Plywood

The long ply sheet may be curved before fitting to the wing. This may be done by damping the *outside* of the ply; leaving for a few minutes and then turning the ply over until the long edges meet. The ply may be tied in this position and left overnight. Tie with tape at several places and assist with long, stiff laths inserted under the tapes.

When the ply is brought to the wing nose, all ribs, the leading-edge stringer and the packing strips should be liberally smeared with glue. Fix the ply by gimp pins, or by wire staples, starting from the centre and working out towards both ends. If staples are used they should be removed when the glue is set.

If the leading edge ply is attached in separate lengths, each scarfed joint must coincide with a main rib. The ply edges are feathered before attaching to the wing, though the actual joint is made "in situ."

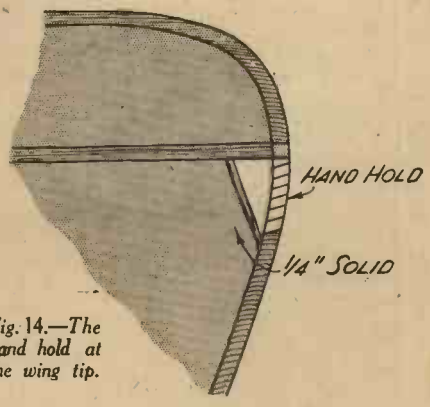


Fig. 14.—The hand hold at the wing tip.

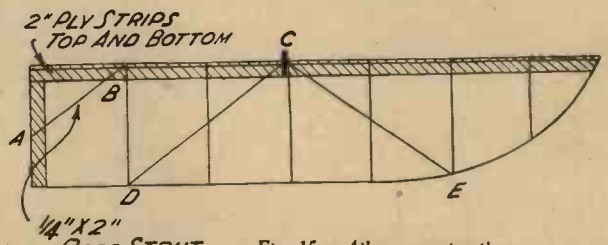


Fig. 15.—Aileron construction.

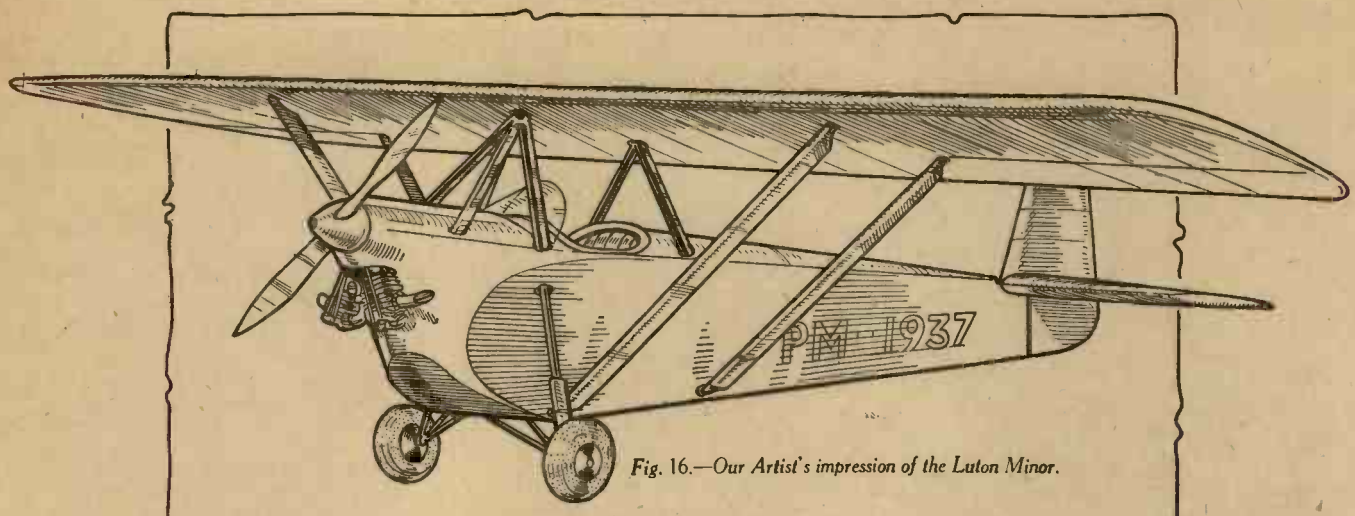


Fig. 16.—Our Artist's impression of the Luton Minor.

A strip of wood is applied at each joint, with paper inserts, the tacks or staples being driven through the strip, ply and supporting member.

Positioning the Ribs

The position of ribs and other members may be pencilled on the outer face of the ply nosing to show where the pinning should take place.

A separate piece of plywood is fitted over each tapering portion of 3 ft. length running from the tip rib to the 4th rib. The wing-tip consists of 4 pieces of ply, two above and two below, the dividing line being the front spar. Before fitting these the diagonals, consisting of a ply web with ½ in. by ⅜ in. flanges, or alternatively of ¼ in. solid spruce, should be fitted. The tip ply is scarfed as before.

A hand hold may be made in the wing-tip by the insertion of a tapered piece of ¼ in. solid spruce, as shown in Fig. 14, the plywood stopping short at this member. The wing-tip bend may be bound with tape where exposed.

The Ailerons

We now come to the ailerons. Fig. 2 shows them covered with plywood but an equally good job, and lighter, may be obtained with fabric covering. If they are to be fabric covered a dope strut, AB of Fig. 15, of section about ¼ in. by 2 in. should be inserted as shown. The aileron lever bolts on the inside face of the rib at C, and stiffeners CD, and CE should be included. These may also be of ¼ in. spruce, tapering from the aileron spar depth to ½ in. at the trailing edge. The ply webs in the intermediate ribs should be slotted to receive these stiffeners. Next fit trailing edge rib portions, i.e. aft of the rear spar, to form the aileron root, leaving a clear gap of ¼ in. between this and the adjacent main rib.

Strips of plywood, 2 in. in width should be fixed along the forward part of the aileron, top and bottom, and similar strips at the root.

The ailerons may now be cut away from the wing, the rib ends being cleaned up with a chisel and sand-paper. Note that if the aileron covering is ply, it is as well to attach the ply on one face before cutting away the aileron clear.

Aileron Hinges

The aileron hinges may now be fitted and should be so arranged that no appreciable sideways movement of the ailerons is possible. Fit also the 2 in. ply strips on the main plane ribs adjoining the aileron roots and fit packing strip—¼ in. by ⅜ in.—to top and bottom faces of the rear spar, between the ribs, over the aileron portion. No packing strip is necessary over the central part of the spar. Except for a general rubbing down with glasspaper and fitting the cables, the wing is now ready for covering.

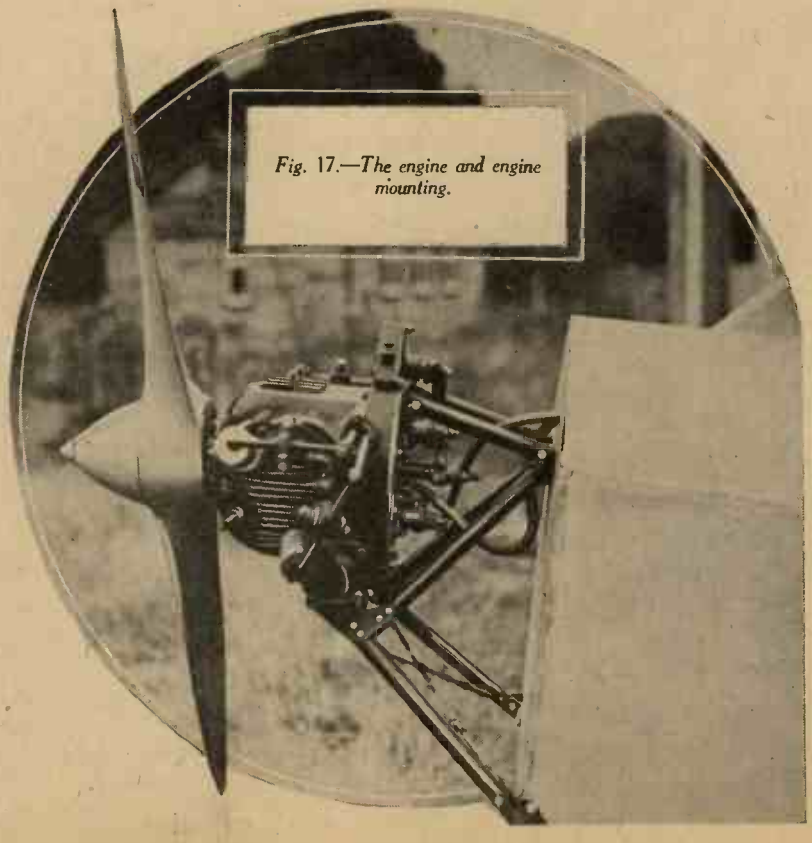


Fig. 17.—The engine and engine mounting.

LUTON MINOR

Price List of Completed Parts

Main plane, covered and doped	£50	0	0
Fuselage, painted	£36	0	0
Tail unit	£17	10	0
Undercarriage, with wheels and shock absorbers	£14	0	0
Controls	£2	0	0
Tanks	£3	10	0
Wing pylons and fittings	£1	0	0
Lift struts (streamline steel tube) and bracing	£6	10	0

Price List of Component Parts, Ready for Assembly

Set main plane ribs	£7	10	0
Main plane and aileron spars	£6	4	0
Fuselage sides made up (cost extra to materials)	£3	0	0
Fuselage made up, complete with decking (extra)	£24	0	0
Complete set fittings and controls made up	£20	0	0

Fig. 18.—Showing the construction of the undercarriage.

The aileron balance cable connects across the bottom aileron levers. Attach a 10-cwt. turnbuckle to one of the levers and to the free end of this splice a length of 10-cwt. control cable (all cables should be of 10-cwt. flexible steel rope, 7 by 14, to specification 4W2). With the ailerons held, or clamped, level, the balance cable is run forward over the lower pulley of fitting 5W, right across the wing to the opposite fitting and out to the bottom aileron lever again, where it is spliced.

10 cwt. turnbuckles are fitted to the two top aileron levers, to which cables are spliced. These pass over the upper pulleys 5W, the inner pulleys 8W, pass through the underside of the wing and connect to the controls in the fuselage. Make these cables of sufficient length so that about 5 ft. hangs below the wing and leave the ends bound but unspliced.

Cables for the Wings

Where the cables pass into the wings, slotted lengths of three-ply may be attached to the ribs, as shown in Fig. 12, to provide attachment for the covering material. The length of slot should be sufficient to leave the cable free in all positions of the aileron.

Note if the cables tend to foul any parts of the ribs, the ribs should be suitably cut away and re-strengthened if considered necessary. This applies also to the drag bracing system dealt with earlier in these notes.

Two Additional Ribs

Figs. 10 and 19 show the modifications necessary if the wing is to be built in two halves. Two additional ribs are required, these being inserted 2½ in. from each root, so as to leave a clear gap of 5 in. when the wing halves are placed together. 2 in. strips of $\frac{1}{16}$ in. ply are attached to the inside of these ribs, top and bottom. Close inside the root rib is the drag strut and close to this again is the fitting 7W to take the drag bracing.

The half wings may be joined either before or after covering. This is carried out by bringing the spar roots close together, carefully aligning the whole wing and bolting on the connection fittings 11W. This may best be done by fitting them to one half beforehand and carefully drilling the spars of the second half when in position.

Omit the two inner bolts in both bottom

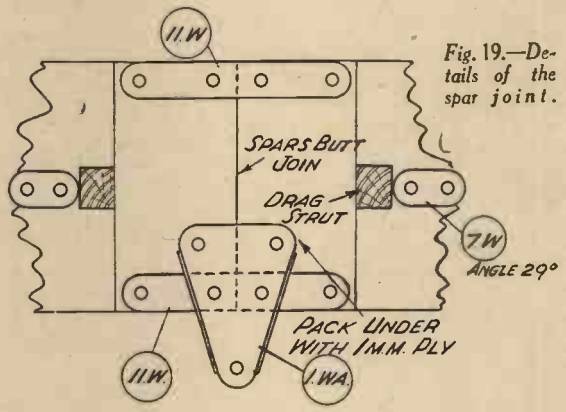


Fig. 19.—Details of the spar joint.

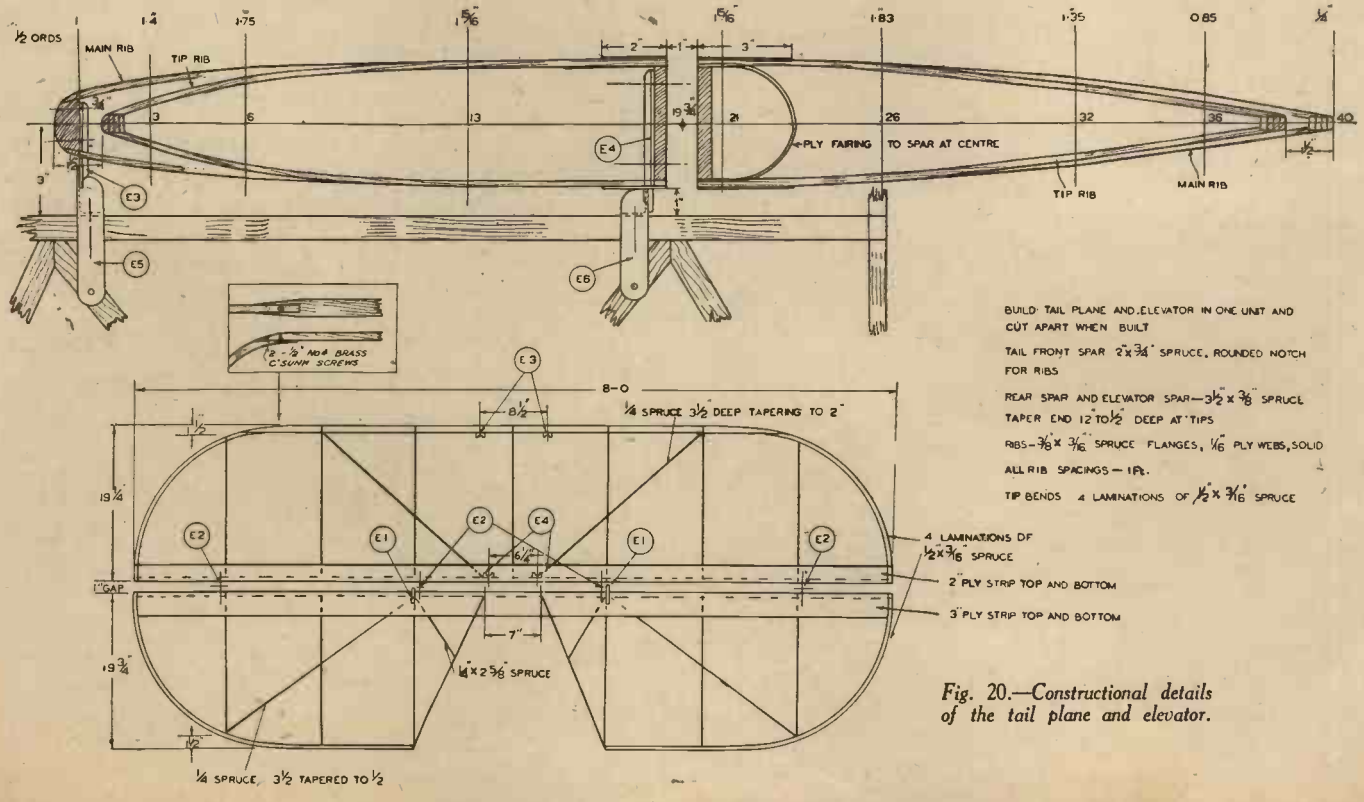


Fig. 20.—Constructional details of the tail plane and elevator.

flanges till last, when the fittings 1WA are placed in position. When the wing is joined a strip of ply should be used for closing the 5 in. gap. This should be at least 7 in. in width and may be glued external to the root ply strips.

See that all bolts and turnbuckles are locked, as previously explained, and the wing is now complete except for covering.

Blue Prints

The " Minor " may be obtained, ready to fly, from the manufacturers, Messrs. Luton Aircraft Ltd., of Phœnix Works, Gerrards Cross, Bucks., the price varying from £180 upwards, according to the engine fitted.

A Method of Loop Splicing Flexible Steel Cables

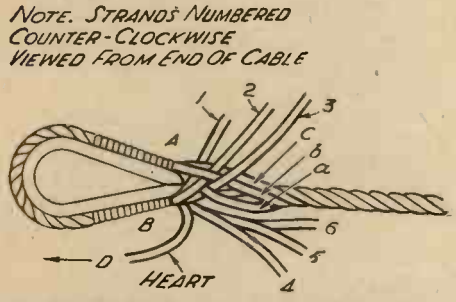


Fig. 21.—First half of No. 1 tuck. Cable serve at A and B with waxed thread. Cable bent round thimble heart turned back in direction of arrow D. No. 3 strand threaded under a. No. 1 strand threaded under b and c. No. 2 strand threaded under b.

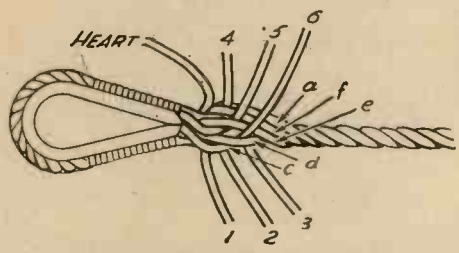


Fig. 22.—Second half of No. 1 tuck. No. 4 strand threaded under f. No. 5 strand threaded under e. No. 6 strand threaded under d. One tuck is completed when each strand has been threaded once.

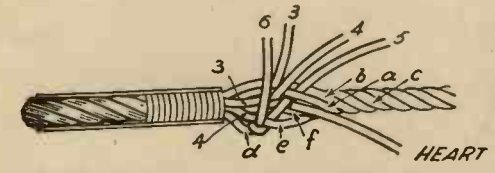


Fig. 23.—Commence of second tuck showing heart tucked in. In the 2nd, 3rd, 4th and the half tucks, the heart is laid along the cable and taken under a suitable strand (in illustration, No. 5 strand), thus forcing the heart into the centre of the splice. In the 2nd, 3rd and 4th tucks the strands 1, 2, 3, 4, 5, and 6 are taken under and over one strand (a, b, c, d, e, f, e.g. No. 3 strand is taken over b under c in 2nd tuck, over d under e in 3rd tuck, over f under a in 4th tuck. Half a tuck is made by threading alternate strands once. A complete splice consists of 4½ tucks. On completion of splicing loose ends cut off flush and served.

Fig. 24.—Showing the complete splice.

Messrs. Luton Aircraft also supply semi-manufactured sets of parts at £75 and complete sets of materials required for construction at £40, or the parts and materials may be obtained in component lots, i.e. wing, tail unit, fuselage, etc., for those who do not wish to put down the total cost initially. Messrs. Luton Aircraft have consented to reply to any queries, provided a stamped addressed envelope is enclosed, and to supply any materials, or small parts, and to carry out any welding that may be required. Furthermore they undertake to supply all types of engine and to allow a reduction to those who purchase both the sets of parts, or materials, together with the engine unit from them.

Those readers who desire to obtain a full set of blue prints, showing all parts drawn out to larger scale than is possible here, should write to Messrs. Luton Aircraft, Ltd., at Gerrards Cross. Five pounds is the cost of the complete set.

* * * *

"Errata." In the table of rib ordinates, given on page 9 of last month's issue, the second dimension in the second vertical column should read 4·55 instead of 4·2, and the dimension 0·5 at the foot of the same column should read 0·64.

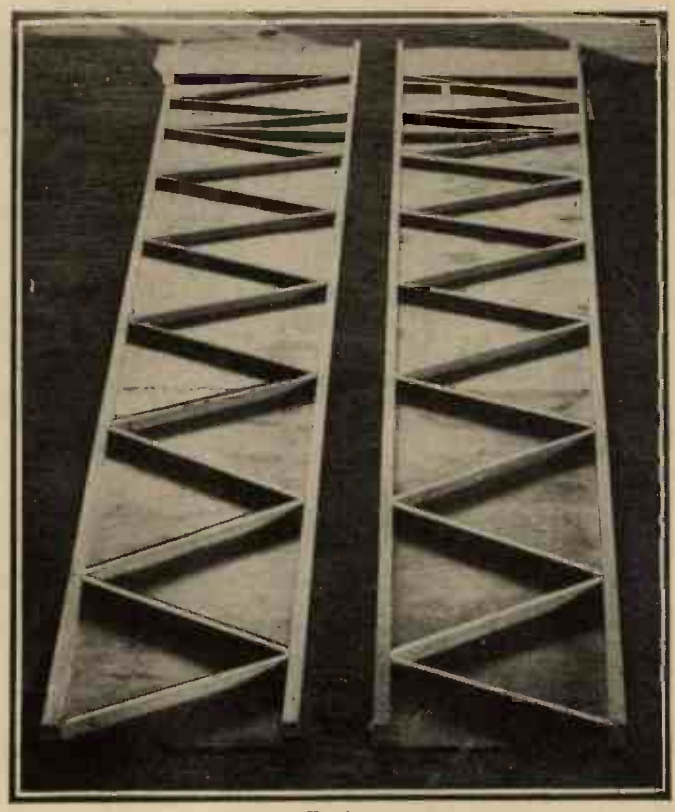


Fig. 25.—The fuselage sides.

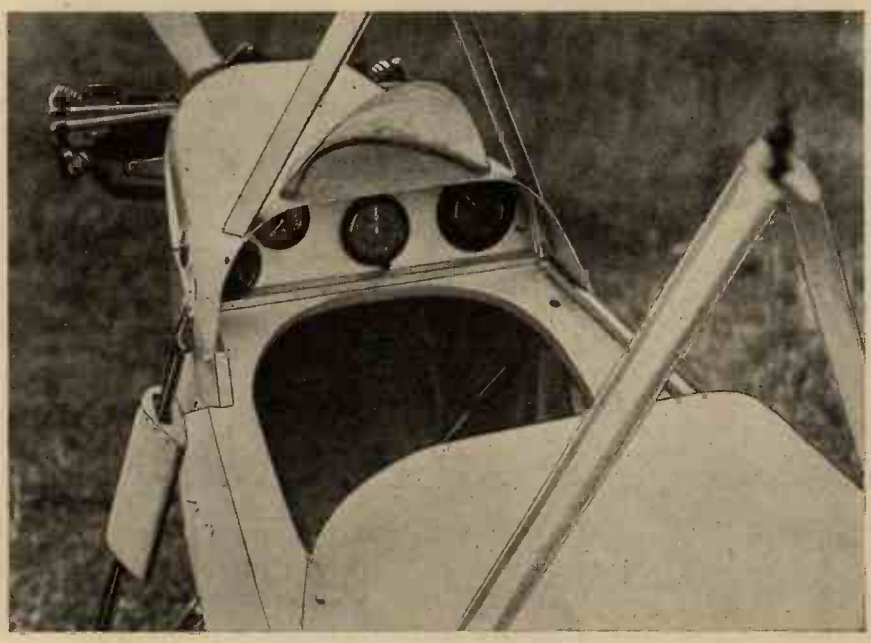


Fig. 26.—Showing the roomy cockpit.

STARGAZING FOR AMATEURS

A NEW SERIES

By N. de Nully

A GUIDE FOR NOVEMBER

NOTWITHSTANDING the approach of the sunspot maximum, there has been no recent spectacular manifestation of naked-eye dimensions. One may, however, appear any day and a look-out should be kept. Meanwhile, the Moon continues to offer fields for exploration whenever the night sky is clear and our satellite is above the horizon. The fine photograph reproduced on this page gives a view of the rugged region lying along a section of the terminator midway between the lunar equator and the south pole, about two days after "full." This area can also be examined under morning illumination five days after "new."

Ring Mountains on the Moon

The prominent triple formation at the left-hand lower corner of the illustration consists (reading from the bottom upwards) of Theophilus, Cyrillus, and Catharina. The first named is one of the noblest of all the ring mountains on the Moon. It is nearly 64 miles across and its massive terraced ramparts tower 14,000 to 18,000 ft. above the interior. A majestic central pile, surmounted by peaks nearly 6,000 ft. high, occupies the approximately circular floor of which it covers 300 square miles. The north-west border of Theophilus overlaps its adjacent neighbour Cyrillus, and a wide gap gives access from the latter to Catharina farther north. These impinging types of walled plains—and there are many—suggest formations at different periods, and furnish strong support to the "erupting gas bubble" theory of their origin. The well-preserved outline of Theophilus may therefore indicate relatively recent creation; while the irregular broken-down condition of Catharina probably points to the crumbling influence of time or more prolonged meteoric bombardment. Cyrillus may similarly represent an intermediate stage of general decay or demolition. Space does not permit of further descriptions; but the stargazer, provided with a small telescope and a map of the Moon (Philip & Son, Fleet Street, London, publish one at 2*s.* 6*d.*), can identify many other conspicuous features when circumstances permit.

Mercury and Venus

Mercury is at present overpowered by the radiance of sunset. Venus may, however, be observed in the brightening sky in the south-east an hour or so before sunrise. Mars can be seen gleaming in the dusk low in the south-west, but it sets at about 9 o'clock. Jupiter is still a prominent object in the same neighbourhood, setting about 8.30 p.m. at the beginning, and an hour earlier at the end, of the month. A transit of Satellite I will be found in progress at 5.45 p.m. on the 11th, and of Satellite II at the same time on the 28th. At that time also on the 5th, 7th, 12th, 14th, 19th and 26th, one of the four principal "moons" will be eclipsed in the planet's great cone of shadow; while on the 3rd, two of them will have likewise vanished. On the 7th at 5.5 p.m. Satellite III will be blotted out and reappear at 8.41 p.m. Owing to its greater distance from Jupiter, Satellite IV escapes eclipse for alternate periods of three years. One of these spells of immunity recently ended, and a disappearance of this satellite may be witnessed (weather permitting) at 7.28 p.m. on the 20th. Saturn rises in daylight and remains above the horizon until dawn. It will be due south at 9 o'clock during the next few nights, reaching that position 25 minutes earlier by the end of each week. The ring system, which has now opened perceptibly, is temporarily closing slightly again; this will continue until the end of the year.

A Remote Planet

The remote planet Uranus will be "in opposition" on the 4th, and at its nearest to the Earth during 1937. But its distance will nevertheless be the vast one of 1,740,540,000 miles. Uranus now rises at 3.37 p.m. and will be above the skyline throughout the night. Its position is close to O (Omicron) in the constellation Aries, which is fairly high in the east after about 7.0 p.m. Though easily perceptible in a binocular, the identity of Uranus should be definitely established by noting its displacement among the small surrounding stars after intervals of a week or so. A celestial atlas will facilitate this. In an instrument of moderate power the planet exhibits a tiny, dull, greenish disc, in contrast to the brilliant points of light shed by its stellar neighbours. Yet, notwithstanding its immense diameter of 31,000 miles (four times that of the Earth, no reliable markings can be detected on its cloud-wrapped surface. The four satellites of Uranus are all much smaller than our Moon and are discernible only in giant telescopes. Practically little is known of that shrouded globe, except that its "year" is longer than 84 of ours and its rotation period but 10¾ hours, the latter representing a day and night of only 5 hours 22 min. each. Its axis is believed to be much tilted towards the level of its track in space. If this is actually the case, it must result in very protracted seasons with those at the poles extending to over twenty of our years. The strength of solar radiation on Uranus is reduced to 1/360th of that on the Earth; and the Sun, as seen from there, can hardly look more than an exceedingly brilliant star having a scarcely perceptible disc. In consequence of its dense impenetrable atmosphere, the Uranians, if there are any, must be quite unaware of the existence of other celestial bodies, unless they are endowed with X-ray sight. Even then our tiny world, and those of Venus and Mercury, would either be perpetually invisible or, for the most part, lost in the glare of sunshine.

A crater-pitted region on the moon under afternoon illumination.

Astronomical Notes

The new comet (1937*g*) recently discovered by Dr. E. P. Hubble at Mount Wilson Observatory, California, is an exceedingly faint object. It is now to the west of the bright star Fomalhaut in the constellation Piscis Australis and is moving slowly southwards. It is, however, almost too low in the sky for observation in these latitudes, even with very large instruments.

* * *

Yet one more hypothesis of the cosmos has been evolved. This contradicts Sir James Jean's "mathematical conception" of an expanding universe, in which all the heavenly bodies are rushing away from each other at terrific speeds. Dr. S. Sambursky, of the Hebrew University, Jerusalem, declares that what is actually taking place is *contraction*, not expansion. He bases his conclusions on the report of Dr. Hubble, of Oxford, some time ago to the effect that the spectrograms of the retreating nebulæ failed to support Sir James's theory. It is interesting to reflect that Prof. Einstein's phantasy of "finite space curving on itself" has already been discarded. Will the others be similarly rejected in turn and their places retaken by the previously well-established and more rational idea of an ocean of infinity where countless suns and their retinues float freely in various directions, without mass tendencies towards either expansion, contraction, or curvature?

* * *

Results of observations of the planet Mars during the current "apparition" have been disappointing, and little has been added to our knowledge of that puzzling world. Unfortunately, its low altitude, as viewed from the northern hemisphere where the big observatories are situated, has rendered the detection of finer details impossible. The most important reports come from Flagstaff, Arizona, and Mount Wilson, California. Photographs taken at the former famous station confirm the reality of the so-called "canals"; also of the occasional temporary veiling of well-known markings by some kind of finely divided dust-like material which is held in suspension in the air of Mars for weeks at a time. But no light can be thrown upon the nature of either. At Mount Wilson Observatory, evidence of the presence of moisture has been distinctly negative. Notwithstanding long exposures of numerous plates, the great spectroscope of the giant Hooker reflecting telescope of 100-in. aperture failed to register the slightest indication of water vapour in the Martian atmosphere. If this deficiency is corroborated at the next two even closer approaches in 1939 and 1941, such tentatively accepted terrestrial analogies as ice and snow and vast vegetation-covered swamps, seasonally irrigated by water from the polar caps, will need considerable revision.

Fig. 1.—The guitar being used in conjunction with a wireless receiver.

ELECTRO-MUSICAL INSTRUMENTS

By L. Ormond Sparks

Some Really Beautiful Effects are Possible Once the Player has Mastered the Technique of an Electrified Instrument such as a Guitar or One-string Fiddle

TO avoid a wrong impression being created by the title of this article, I wish to stress that it does not refer to automatic musical reproducers operated by electricity, but to instruments which depend on electrical oscillations, of an audible musical frequency, for the creation of a certain band or range of musical tones.

Since the development of the thermionic valve as an oscillator and amplifier of audible frequencies, there has been many systems developed for the production of musical tones, but for some unknown reason, they do not appear to have attained any degree of popularity.

Many will remember the broadcasts given by Professor Theremin with his electrical instrument, the range of frequencies of which is governed by a variation in the capacity of an oscillatory circuit, such variation being obtained by the position of the player's hand with relation to a small rod which projects from the top of the instrument.

A Remarkable Instrument

Other systems which made use of the oscillating properties of the thermionic valve were those developed by Dr. Trautwein—the Trautonium, a most remarkable instrument; B. Helberger and P. Lertes invented the Hellertion, while J. Mager—who was one of the first scientists to investigate the subject—produced the Sphaerophone.

All of the above are of the "single note" type, by which I mean it was not possible to produce, at the same moment, a number of tones or a chord, although it is possible to arrange the operating devices so that more than one instrument is under the operator's—I suppose I should say player's—control, thus allowing simple chords to be produced.

While such developments were concerned solely with the valve as an oscillator—the resultant notes being, of course, amplified by other valves—other investigators proceeded along rather different lines, namely, the conversion of mechanical vibrations of a musical frequency into electrical variations.

The Electro-Mechanical Method

In this direction, it is interesting to note—after the foreign inventors of the other system—that as far back as 1929, J. Compton, an Englishman, applied for patents relating to the method about to be described.

One might describe this method as electro-mechanical as against the purely electrical arrangements employing the characteristics of a valve or valves for the simple reason that it depends for its operation on the vibration of the material (strings or wires) which normally produce musical notes, creating weak electrical currents of an identical frequency which are then amplified and reproduced by means of a loudspeaker.

The sound produced by any string instrument is, normally, very weak unless good use is made of a sounding-board. It being well known that the tonal quality and amplification of the sound produced is governed solely by the efficiency and design of such sounding-boards. One has only to consider such examples as the violin, 'cello, or piano.

Bearing in mind the craftsmanship and selection of material—apart from time—necessary to produce a high-grade sounding-board, it will be appreciated that the initial cost is bound to be high. It is, therefore,

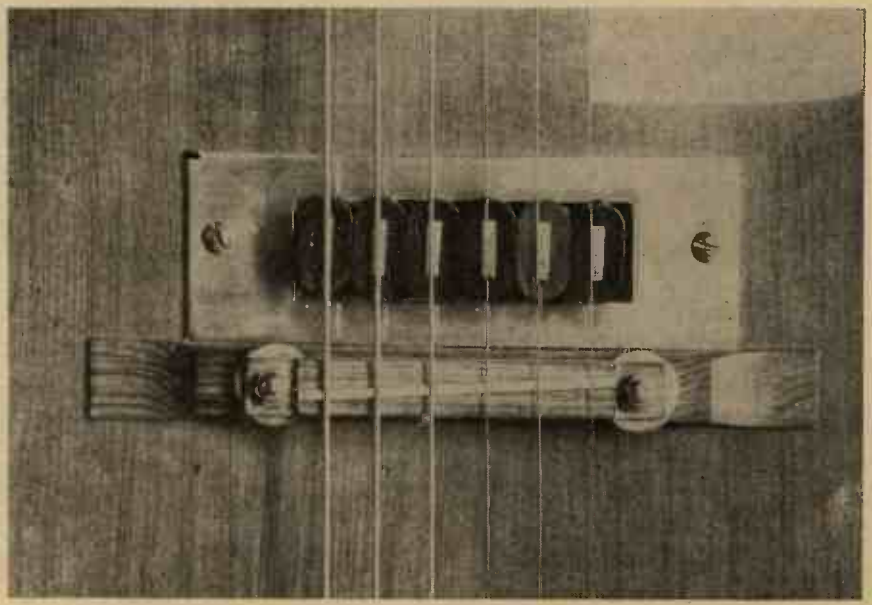


Fig. 2.—A close-up view of the unit fitted to a guitar.

in that direction that the electrical equivalent differs and scores most, as the whole sounding-board system can be dispensed with entirely.

Instruments fitted with Microphones

One is not concerned with sound but purely the vibrations, and it will be seen, later, that it is immaterial whether the strings are mounted on a length of planking or the finest piece of mahogany. I might add at this stage, that certain instruments have been classified as electrical when they are nothing more than a standard instrument fitted with a microphone. Apart from this mention, they are not worthy of inclusion in this article, as the tonal response is not likely to satisfy a critical musician.

The First Instrument

The first instrument I made was, strangely enough, not for use in a musical sense. It was not made with the idea of being played, but merely to assist in certain experiments I was then carrying out with loudspeakers. It was only at a later date that I applied the same idea to musical instruments, the guitar being selected because of its appeal and popularity.

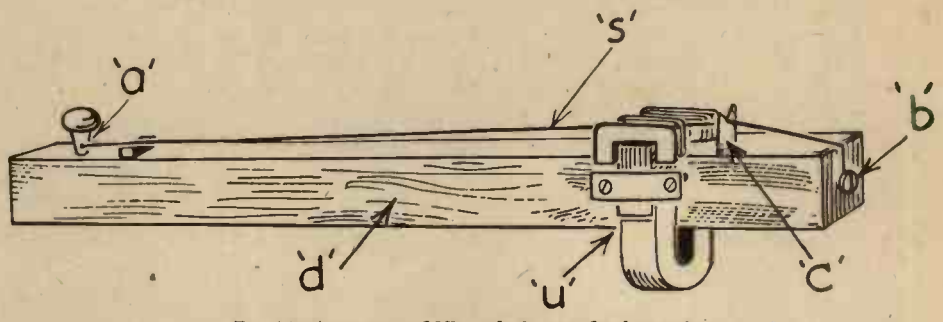


Fig. 4.—A one string-fiddle with the unit fitted into place.

The sketch (Fig. 4) shows the basic idea of the system, and it will be recognised by anyone with any knowledge of the elementary principles of electricity, as an application of the theory of the early dynamos.

The wire *s* represents the "string" of the instrument, it being firmly fixed between the two points *a* – *b* with a simple device to vary the tension, fitted at *a*.

The vertical metal strip *c* acts as the "bridge," and maintains the wire at a certain distance above the baseboard *d*, which in the first model was a piece of ordinary pine wood.

At the point *U* is fitted the unit which is shown in detail by Fig. 5. It will be seen that the unit consists of a horseshoe magnet *m*, to which is bolted two soft-iron pole-pieces carrying the bobbins *e* and *f* which house spools of very fine wire.

The unit is so fixed to the instrument, that the wire *s* is free to vibrate in the gap *g* between the pole-pieces, thus creating in *e* and *f* minute electrical currents having a frequency identical to that of the vibration of *s*.

Producing Notes

If it is desired to produce notes other than the fundamental, *i.e.* the note produced by the open string, it is only a matter of sliding a finger along *s* and depressing it against the base-board, after the method adopted with a one-string fiddle.

The weak electrical currents have to be amplified before they are capable of operating a loudspeaker, and it is necessary to see that both the amplifier and speaker are capable of handling—without distortion—the frequencies under consideration.

Those interested in carrying out tests of apparatus at certain musical frequencies, will see how the apparatus readily lends itself to such work, as it is capable of producing notes over a very wide range.

The one-string fiddle effect mentioned above, tempted me to convert one of those instruments to the electrical method, and I must say that the effects produced—when it is in the hands of a capable player—are very different to those usually associated with such an instrument. As a point of interest, I once had it played—by a musician—in a large dance hall, and although I was using only a 5-watt amplifier, I had to keep the control well down, otherwise the intensity of sound was more in keeping with that of a small organ.

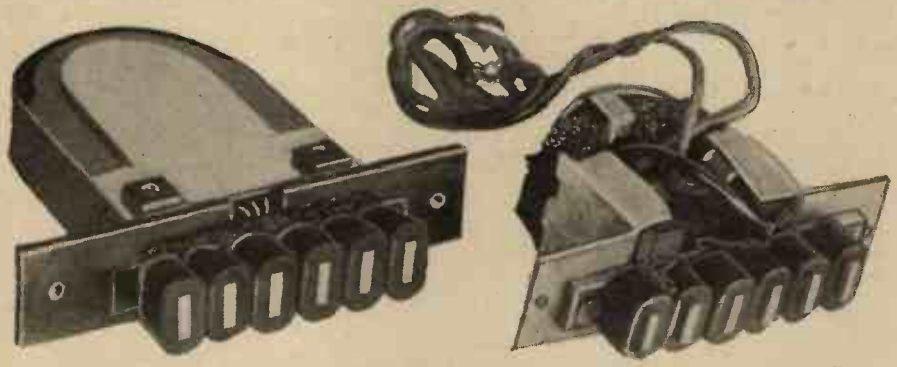


Fig. 3.—(Right) A view of the unit which is fitted to the guitar. (Left) The first guitar unit made.

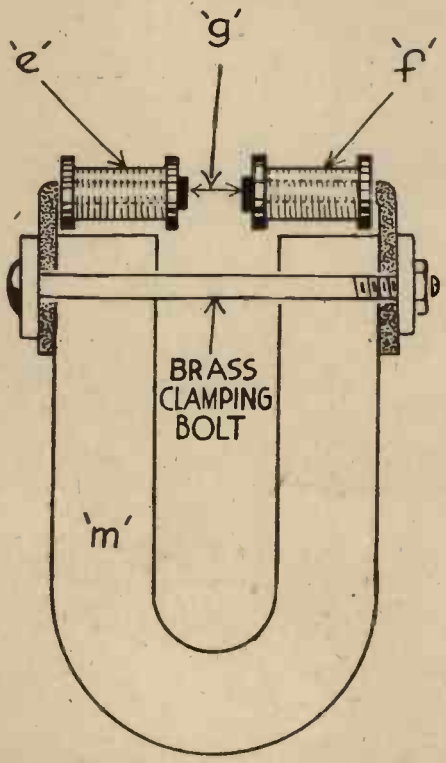


Fig. 5.—Details of the unit used for the one-string fiddle.

The Guitar

The next instrument I converted was an ordinary very cheap guitar. I selected a cheap model for two reasons. Firstly, I did not wish to pay a big price for something to be used for experimental work and, secondly, I wished to prove that the quality of the belly or sounding-board would not affect the tonal response.

The big snag with the making of the unit was to provide six pole-pieces each having similar flux densities. Bearing in mind that the complete magnetic system had to be compact and light and that space—the distance between strings—was rather limited.

The arrangement used for the one-string fiddle could not be used, therefore, I devised the unit shown in Fig. 3 for my first model.

The belly of the guitar was cut just in front of the bridge, and a slot made sufficiently large enough to take the bobbins. The unit being bolted on to the belly. It was soon found, however, that such an arrangement was not good enough to satisfy a critical musical ear.

There was the question of relative output of each string, owing to the vast difference in fundamental frequencies. There was also the question of microphonic noises and the little matter of sustained notes and plectrum "flick." However, these snags were eventually removed, and the resultant unit was such that it could be fitted to any guitar—and providing the instrument was suitable—it could be used in Spanish or Hawaiian fashion.

Separate Pick-up Coils

Many of the commercial models—chiefly American—do not make use of a separate pick-up coil for each string, but rely on one pick-up arrangement covering the complete range of frequencies. Again, many of them have taken advantage of the fact that a sounding-board is not required, making the body or belly of the guitar out of metal. That is quite in order, but, if—as I have seen happen—the associated amplifier packs up during a performance, the instrument cannot be used as an acoustic model as my design allows.

The photograph of the complete guitar—arranged for Hawaiian playing—shows that the unit is neither unsightly or cumbersome. In fact, it does not affect, in any way, the playing of the instrument as an ordinary model if so desired.

Personally, I favour finger playing but, if a plectrum is used, I would suggest that one be made from fairly stiff material with a soft surface, such as rubber, felt, or leather.

SCIENTIFIC CRIME DETECTION

Often a Single Hair is the Only Clue in a Murder Case, but with the Help of Modern Apparatus it Has Often Been the Means of Finding the Murderer

A substituted corpse being examined at the scene of a hypothetical crime-training school.

IN the dim, dark days of mediæval times anyone who was accused of witchcraft—and "witchcraft" might have meant anything from a particularly malevolent squint to a rudimentary knowledge of herbalism—was most direfully done to death by rack and rope, by fire and faggot. Witchcraft was a crime! As recently as the last century sheep-stealing was a penal offence and sentence of death was commonly passed for quite petty larcenies which to-day would be met by "binding over" or the merciful amenities of the Second Division.

Truly justice is to-day tempered with mercy, but the death penalty is still with us, and while opinions differ as to the rights or wrongs of capital punishment, many very eminent scientists are agreed that crime is, if not an actual disease, at least an abnormal mental condition calling for ameliorative treatment rather than condign punishment.

Lombroso's Work

It is a curious fact that up to 1876, when the eminent Italian scientist Lombroso published his famous book 'L'Uomo Delinquente" ("The Criminal"),there had been no real attempt at an unbiased scientific study of the criminal-minded.

For quite a time Lombroso's work (which laid down a hypothesis of certain physical, and particularly cranial, types being foredoomed to criminal development) was accepted as gospel, and no allowance was made for the effects of heredity and environment in the development of the criminal urge. This theory was, very soon, vastly modified by the teachings of the Dutch investigator, Bongar, who proved conclusively that economic conditions produced criminals of quite contrary types to Lombroso's "pattern." Then, in 1913, Dr. Charles Goring, Medical Officer to H.M. Prison Service, published his fascinating work, "The English Criminals," which finally exploded the myth and proved there is no such thing as a hard and fast "criminal type." Goring's work has been elaborated by the researches of such men as Jung and Freud, until to-day the study of the criminal and his mental processes is definitely in the hands of the psycho-analysts and psychiatrists.

Science, by probing into the depths of the mind, and analysing the thought processes of criminals, is doing more to prevent crime than the general public appreciates; but science is also very much to the fore in the actual detection of crime once it has been committed.

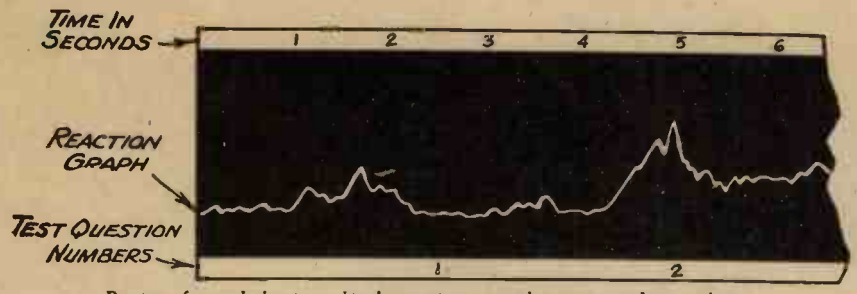
The Laboratory Detectives

Every day the Sciences—Chemistry, Physiology, Biology, Physics, Ballistics and many more—are evolving new and surer methods, not only of catching the malefactor, but of proving, once he is apprehended, that he, and only he, could have committed the crime under investigation.

Successful war against organised crime is now to be waged by the methods of the machine-gun and "Third Degree" in the hands of a strong-arm squad, but by logical deductions painstakingly worked out by mild-mannered laboratory technicians who are, even now, able to produce more concrete facts about a crime than all the spectacular "sleuths" who ever lived in or out of a Penny Dreadful.

Let us look, for a moment, at the Bertillon system. To most people this simply means "finger-prints," but Bertillon went much further than this, and the proper name of this science—for science it is—is Anthropometry, or "Man Measurement," all his

The bore-prints on missiles fired from criminals' weapons carry an infallible clue, just as the assassin's own finger-prints do.



Portion of record showing subject's reactions to each question and time taken.

physical attributes contributing to the "record" of the malefactor.

Finger-prints are by no means a modern development, for the impress of the thumb was the sign manual of emperors in the East many centuries ago, and the idea still lingers in modern legal parlance when we speak of an "act" or "deed." Even Bertillon's classified system of finger-print classification was forestalled as far back as 1823 by Professor Purkinje, of Breslau, who suggested a detailed system on precisely similar lines.

A Wonderful Plastic Substance

Now, to further confuse the delinquent comes Dr. A. Poller, of Vienna, who ha invented a wonderful plastic substance called "Negacoll" which, applied to *any substance*, produces an exact fascimile, so accurate that permanent records of finger-prints on safe-doors, thumb imprints on the throats of strangled victims, and even the exact contour and position of a stray hair, may be made for perpetual reference.

This substance, which has been so successful that the Austrian police are now using it in lieu of the old "inky-finger" system for criminal records, is simple to apply, and being of a semi-elastic consistency, can be applied to objects which would be impossible to reproduce otherwise. A cast of the human ear, for instance, can be made *in entirety* and the matrix of negacoll slipped off like a rubber glove.

But the malefactor himself is not the only one to leave finger-prints.

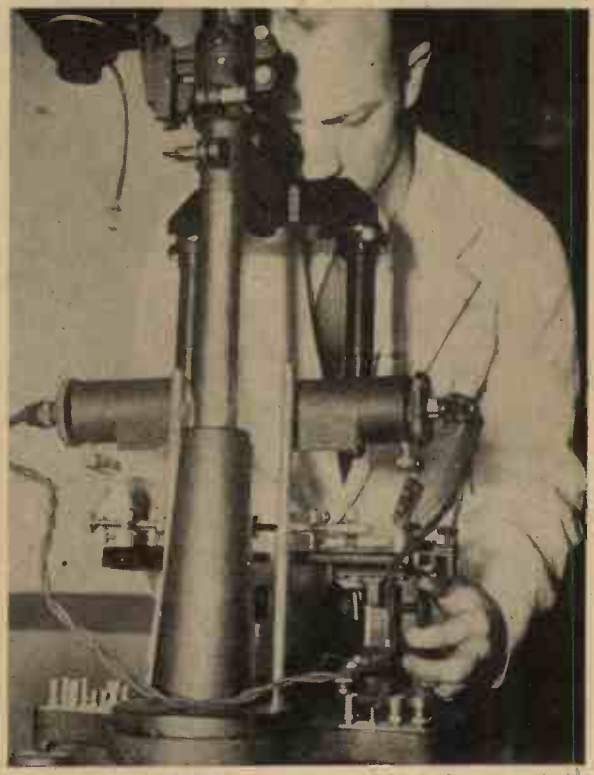
Let a murder be committed by shooting and, given the fatal bullet, experts in the science of ballistics can tell not only what kind of weapon was used but the actual weapon itself, for the passage of the bullet through the weapon's barrel imprints on its surface microscopic markings which will be duplicated with exactitude by *no other weapons whatsoever*, just as the murderer's own finger-prints cannot be duplicated.

Forgery and the Quartz Lamp

Forgers, too, are in for a thin time for, what with ultra-violet rays and the Quartz Lamp, their most painstaking efforts are of no avail. Two documents which, not only to the eye but also to the miscroscope, look alike, fairly shout their differences under these amazing rays. The slightest difference of texture in the paper, the minutest variation in composition, or age, of the ink, and the document reacts to the magic "light" in a way that leaves absolutely no room for doubt. Even his body is no longer the criminal's own, for if he bleach his hair, dye his skin, inject his eye-pupils with false pigment or, as a last resource, maim himself, there are physiological records of his blood content, nerve reflexes and other data which will trap him.

Let him be the most coldly calculating liar since Ananias, and he will still be found out, for a variation of the Sphygmomanometer will record, on an inhuman paper ribbon, his heart and pulse reactions to test questions, even though his face remains immobile and he flicker not even an eyelash!

The wildest deductions of Sherlock Holmes are every-day events in the laboratories of criminology. The very dust in the turn-ups of the criminal's trousers tell of his habits, occupations and habitat; so the old saying that crime does not pay is becoming more forcibly truthful every day,

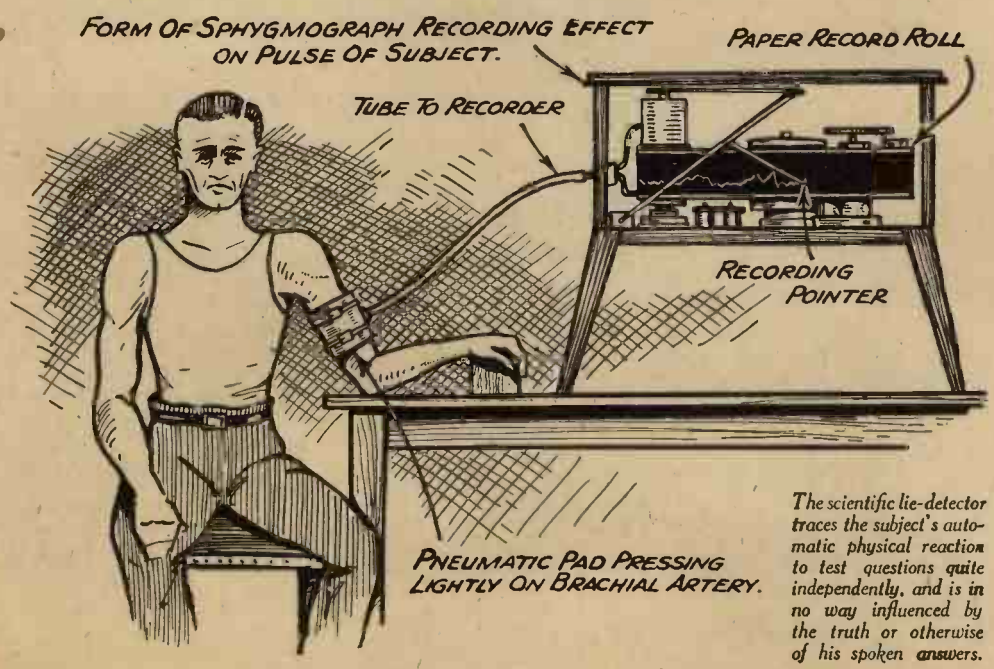


Examining bullets under a comparison microscope to determine whether they come from the same gun.

and *that is what science is working for.*

Catching the criminal is a wonderful part of the march of science, but it is not the goal. The ultimate aim of science, is to eliminate the criminal—to make crime not worth while. Criminals to-day, if they want to keep their collars on, have to be clever men, for what we have discussed here is a mere moiety of the armoury science is pressing into use against crime, and a clever man knows just when the game is no longer worth the candle.

The days of the hooligan and the Bow Street Runner are gone for ever, the day of the detective and the gangster is passing, and ere many decades, let us hope, the elimination of the criminal will make scientific detection no longer necessary; then many great brains and much useful knowledge may be turned to a more profitable use.



The scientific lie-detector traces the subject's automatic physical reaction to test questions quite independently, and is in no way influenced by the truth or otherwise of his spoken answers.

NOTES ON PETROL-DRIVEN MODEL AEROPLANES

By C. E. B.

The Evolution of the Petrol-driven Model Flying Boat

Fig. 1.—Captain Bowden's flying boat is shown in the foreground on the water.

Success at Last

ON September 9th, 1937, I tried out my recently constructed and latest flying boat, "Little Audrey," on the large sheet of inland sea-water off Poole Harbour. The flying boat had only been tested once for gliding over land, with a short taxying test in shallow water to see if she was properly balanced on the water. Fig. 1 shows the boat on the surface of the water. Mr. Brooks and Mr. Paine, both official timekeepers of the Bournemouth Model Aeroplane Society followed in a dinghy armed with stop-watches.

The flying boat engine failed to produce full revs. on the first attempt, and the model went off misfiring badly. The model taxied over the surface of the water which had a considerable "popple" on it for about a quarter of a mile before the engine stopped. Fig. 2 shows the model taxying. The model then waited to be retrieved, and in spite of a fair wind, remained upright on the surface with no tendency to capsize. This proved the boat to be stable on the water, and with the correct side areas to keep it into the wind.

It was then found that our flying ignition batteries were not up to scratch. So two batteries had to be installed on the flying boat instead of the usual one and these were unfortunately well behind the C.G.

The engine now roared off under full revs. and on releasing the model it taxied rapidly into wind for perhaps ten to fifteen yards, rose on to its steps, and then took off amidst great enthusiasm of the watchers. Fig. 3 shows the boat in the air.

In the Air

It was certainly a very pretty and intriguing sight and something quite new. The model flew for just over thirty seconds before landing with a splash. She remained upright, however, and sat quietly on the water head into wind until retrieved. The extra battery had obviously caused the stalled landing.

Some sea spray had wetted the engine and with the dud batteries only available the engine could not be induced to restart before dark in order to make a further attempt at a longer flight.

We had to be content therefore with the fact that this was the first officially observed, and as far as known, the first petrol model flying boat to rise off the water in

Fig. 2.—The flying boat taxying into the wind on reduced throttle.

Great Britain followed by a short flight. As my leave at Poole was up the next day, any further attempt had to be temporarily

Fig. 4.—The writer's first biplane flying boat on Loch Lomond.

left in abeyance. Perhaps later, and before the winter descends upon us it may be possible for timekeepers, leave, boats and

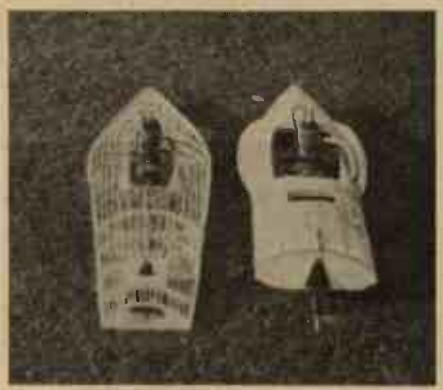


Fig. 5.—"Jildi Junior" on right and the old "C" class hydroplane record holder. On the left can be seen "Jildi Junior" immediately before covering with silk and dope.

Fig. 3.—The first officially observed flying boat to rise off water shown in the air with engine stopped.

suitable weather to be synchronised and we will have another afternoon's fun.

I hope this episode may result in stimulating interest and effort in connection with petrol driven model flying boats.

It is undoubtedly a most intriguing branch of model aeronautics, and there are more problems to overcome than with the normal petrol-driven land 'plane.

A Few Considerations of Design

To keep a model flying boat down to a reasonable size, only a limited capacity of engine can be used. The engine has a lot to do to move the boat over the surface of the water sufficiently fast to gain flying speed.

This can only be done by selecting the correct wing loading and the correct water loading. Also the step or steps on the hull must be in the correct position to overcome the tendency of the engine to pull the nose down and so dig in. For it will be realised that if only one engine is to be used this engine must be fairly high above the hull to allow for propeller blade clearance.

The high thrust line will, therefore, naturally tend to pull the nose of the boat down and around the low centre of resistance of the water. However, by choosing suitable planing angles and locating the steps in the correct position this can be overcome.

Lateral Stability

Furthermore, there is the very difficult problem of lateral stability on the water. For the boat must be able to resist being blown over when on the surface. Full-size boats generally use outboard wing tip floats.

But on a model either one or the other float will be on the surface at the beginning of the take off. The water resistance of this float positioned so far out from the centre will tend to slew the hull around out of wind and so ruin the take off.

The First Flying Boat

I have now built three flying boats with small petrol engines in them. The first boat was a biplane and was stable on the surface owing to a broad hull, and keeping the over-all span short due to the biplane arrangement, but unfortunately the step on the hull was incorrectly located. This model would fly well if hand launched and

it would glide well and land prettily, but it would not take off due to the nose of the hull digging in.

Fig. 4 shows the first biplane flying boat sitting on the edge of Loch Lomond lake in 1934. A 9-c.c. Brown engine was used in this model and was one of the first "Brown Juniors" to reach this country.

Model Speedboats

I then became interested in the 15-c.c. class of model speedboat. I felt that if the model aeroplane principle of construction were to be used in conjunction with the small 15-c.c. aero engine that Mr. Westbury had produced for me when we were collaborating after the War to produce smaller petrol model aeroplanes, I might be able to get a really decent speed on the water that would put the "C" class (15 c.c.) boat into the picture and so stimulate interest in this class.

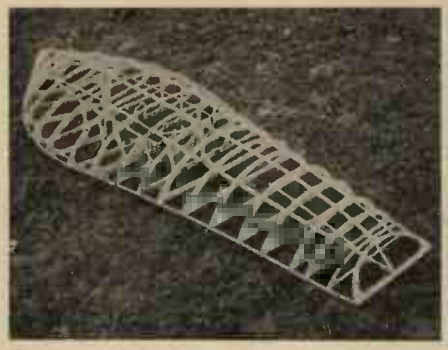


Fig. 7.—The hull shown in Fig. 6 is now completed on both sides. Stringers have to be glued in place, and the final covering of $\frac{1}{16}$-in. sheet balsa, silk, and dope. Note the streamlined shape.

Fortunately for me at this time I was in Scotland, and Mr. Rankine, of international model speed-boat fame, became interested in my efforts. He took off the old "Atom Minor" aero engine that had captured the model aeroplane record for me, and he did a little of his famous "hotting up," so that the engine just did not burst. This engine it must be remembered was designed as far back as 1931, and was then designed as a medium performance and reliable little petrol engine for aero work. I built a hull called "Jildi Junior" on model aeroplane lines, and this combination put up a record on the water for the "C" class hydroplane. The speed had now been pushed right up and become interesting, and the engine speed fiends came out of their lairs and started to produce really hot stuff 15-c.c. engines and set about my record. As a result the 15-c.c. speeds are now soaring in the neighbourhood of the 30-c.c. boats.

Suffice it to say that "Jildi Juuior" was constructed from 3-ply, stringers of $\frac{1}{16}$-in. by $\frac{1}{16}$-in. birch, and balsa wood. The whole hull was more or less streamlined. It was

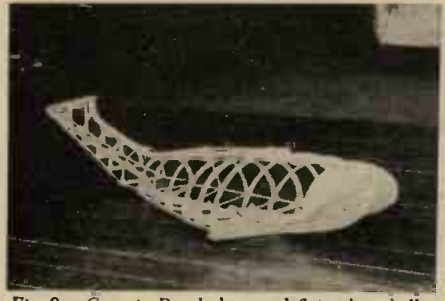


Fig. 9.—Captain Bowden's second flying-boat hull in skeleton. The boat is seen complete in Fig. 8 and the finished hull in Fig. 10.

Fig. 6.—Captain Bowden's 30-c.c. racing hull half finished. One side is built on to a centre backbone of balsa wood.

covered with silk, doped with aeroplane dope and painted. Naturally it was light for its class and its streamlining helped the small engine. Fig. 5 shows "Jildi Junior" on the right, whilst on the left can be seen "Jildi Junior II" in skeleton form and before receiving its covering of silk and dope.

This latter hydroplane was more streamlined and far more stable as I had naturally learnt a few things from the first hull. But my engine power remained the same and I now only use the boat for local competitions. She manages to win the occasional local competitions here and there, but her leading opponent's engines outclass her in the big international events. A full description of "Jildi Junior" was given in PRACTICAL MECHANICS.

Before leaving the subject of hydroplane construction, Figs. 6 and 7 may interest the reader. For these will very clearly show how my latest type of hydroplane hulls are built up. And from these hulls the flying-boat hull has emerged as will be seen later.

Fig. 8.—The second flying-boat model, produced as a result of experience gained on model hydroplanes

Fig. 6 shows one side of a 30-c.c. hull, built on to a balsa wood backbone.

The half oval formers also of balsa wood, except where greater strength is required, such as at the step, are glued on to the balsa backbone.

For those who are not conversant with balsa wood, it is an incredibly light wood

Fig. 10.—The flying-boat hull now covered with its $\frac{1}{16}$-in. sheet balsa and doped silk.

much used for model aircraft building. It has very little strength however, and has to be used so that the strength is obtained in the design and shape.

Fig. 7 shows the same hull with the skeleton framework completed.

On to this skeleton a number of $\frac{1}{8}$-in. by $\frac{1}{8}$-in. balsa strips are glued about $\frac{1}{2}$ in. apart. These stringers are then covered with $\frac{1}{16}$-in. sheet balsa which is sandpapered smooth and then covered with silk and doped with aeroplane dope. Due to the shape the hull is now exceedingly strong and able to withstand the tremendous power of the modern 30-c.c. model racing engine.

The Second Flying Boat

From these hydroplanes a second flying boat hull emerged. Fig. 8 shows the model. This model has not yet altogether proved a success due to the fact that it came out heavier than anticipated, and the small engine of 6 c.c. it was designed for proved unequal to the task of the take off.

However, with certain modifications which I may find time to carry out in the future I still think that this boat will be a success. The model flew extremely well hand-launched.

Fig. 9 shows the hull in skeleton form before being finished off as described in connection with the hydroplane hulls.

Fig. 10 shows the hull of this flying boat finished and with its covering of $\frac{1}{16}$-in. balsa sheet, silk and dope. The hooks can be seen that hold the wing assembly to the hull by elastic bands. In this way damage is not done if the wing hits anything on landing or during flying. The tailplane is similarly attached. The engine and its mounting are also held in position by elastic bands. Thus the minimum of damage is done in an accident.

The Third Flying Boat

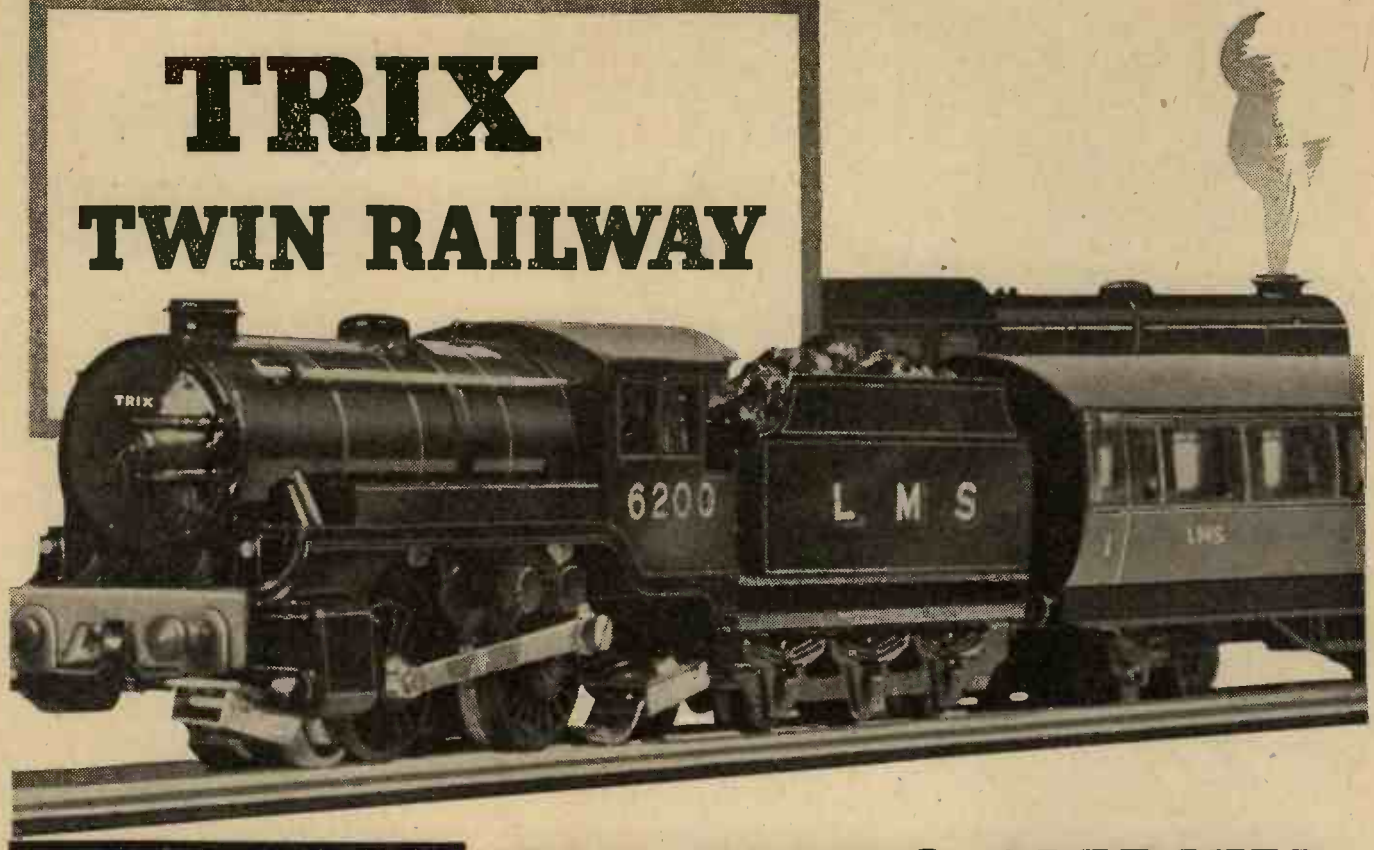
Space forbids a really detailed description of the successful boat which rose off the water and was officially observed at Poole, but the main points may be of interest in conjunction with my remarks at the beginning of this article and may be of use to anyone contemplating building a petrol driven model flying boat. I can assure them that they will get endless thrills and amusement from such an adventure.

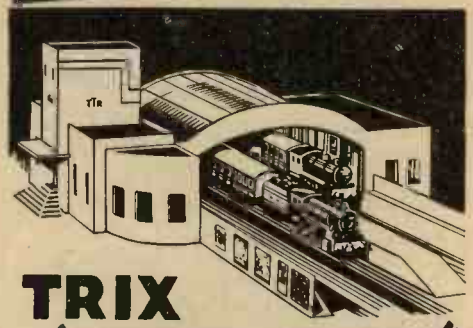
The third and successful boat is very elementary, and is merely the preliminary to a further and more beautiful and ambitious boat. But this may have to wait for some considerable time before the time and opportunity can be found to build it. Nevertheless the data and experience are all there.

The hull is very wide and so dispenses with outboard wing tip floats. It is not too wide, however, to cause excessive water drag for the available horse power to get

(*Continued on page* 93)

TRIX
TWIN RAILWAY





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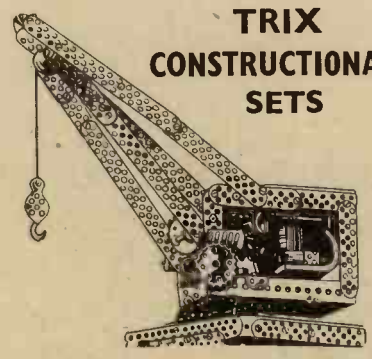

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TRICKS WITH TRAYS AND PLATES

By Norman Hunter

(The Well-known Conjurer of "Maskelyne's Mysteries")

Further Articles on the Secrets of Conjuring will appear Regularly and Exclusively in this Journal

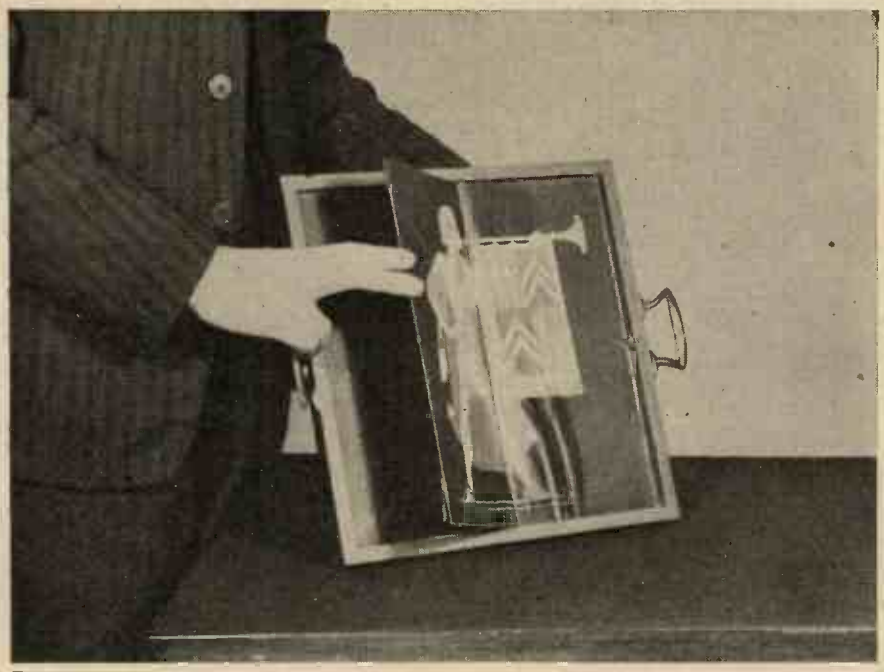


Fig. 1.—A tray with a spring flap which, when released, flies over and converts the tray from a patterned to a plain one.

ONE of the advantages of using a tray, or its small brother a plate, for conjuring purposes is that it can be so easily packed. Several trays, especially if they are of graded sizes, will fit into very little space in a suit case, leaving the conjurer ample room to accommodate his other properties. Another advantage is that in most cases the tray is used apparently as an unimportant accessory to the trick and does not, therefore, invite suspicious attention.

The first tray trick I am going to describe is one which I performed nearly a hundred times at Maskelyne's. The effect is that a tray is shown, on which is printed a design of a Trumpeter, in bright colours. A large white handkerchief is shown on both sides, folded and laid on the tray. When the handkerchief is removed the tray is seen to be quite blank and the Trumpeter design has been transferred to the handkerchief.

A Special Tray

The tray is specially made for the trick. There is a flap covering half the surface and hinged across the centre of the tray. The flap is fitted with a spring so that normally it lies flat on one side of the tray. It can be folded over and held down on the other side with a catch but when the catch is released the flap flies back to its original position.

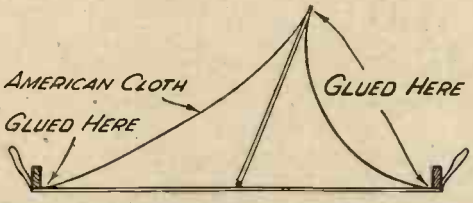


Fig. 3.—How the tray and flap are covered with American cloth.

The whole of the tray and both sides of the flap are covered with dark coloured American cloth. The flap is forced over and secured while the Trumpeter design is painted on the surface thus exposed. It will now be clear that when the catch is released the flap will swing over and hide the design, leaving the tray blank. Fig. 1 illustrates the flap in the act of turning over. There is a small ball catch visible by the handle on the right of the tray. This serves to hold the flap down securely after it has swung over and precludes the possibility of it kicking up above the tray edge, for in that case it would be observed.

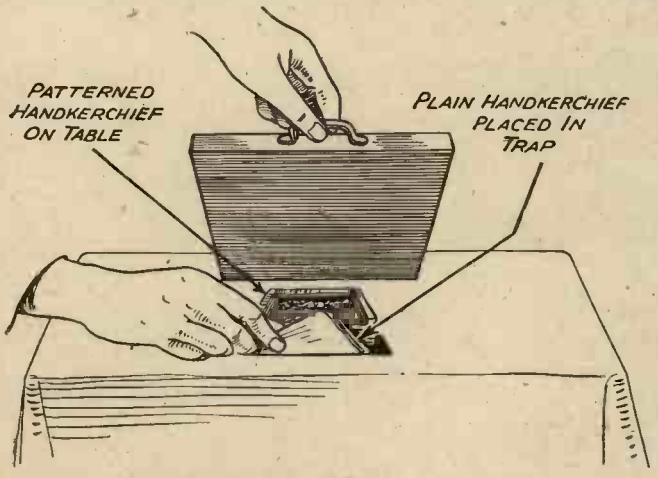


Fig. 2.—Details of the trap underneath the tray.

Fig. 4.—A soup plate with a false base.

There are, of course, two handkerchiefs, one plain and one with the same design as that on the tray, painted on the silk.

Performing The Trick

My method of performing the trick is as follows. The flap is folded over and fastened so that the design is visible. It is then laid on a table fitted with a black art well, or open tray near the back edge. Under the tray and just in front of the trap is the handkerchief bearing the design, folded so that no part of the design shows.

The first step is to show the plain handkerchief and fold it. It is then held in the right hand and the tray is picked up by the handle on the side furthest from the audience. The tray is lifted with a sort of hinging movement forward. This keeps the duplicate handkerchief concealed. The visible handkerchief is apparently placed on the

Fig. 5.—Crumpled handkerchief held behind newspaper.

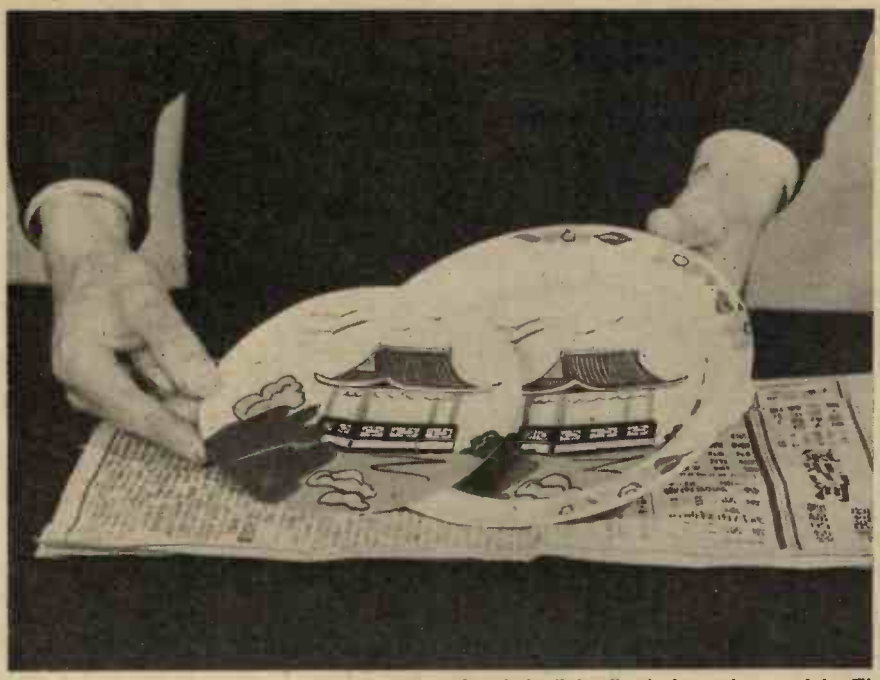


Fig. 6.—This plate has a loose disc matching the plate, under which silk handkerchiefs may be concealed. The flap is held in position by catches on the back of the rim.

table and the tray carried away. Actually the handkerchief is tucked into the open well and it is the folded handkerchief with the design on it which is now in view. The movement is explained in Fig. 2.

The tray having been shown, it is held in the left hand with the bottom of the tray turned towards the audience while the folded handkerchief is picked up. At this moment the release catch is pressed by the hand holding the tray and the flap flies

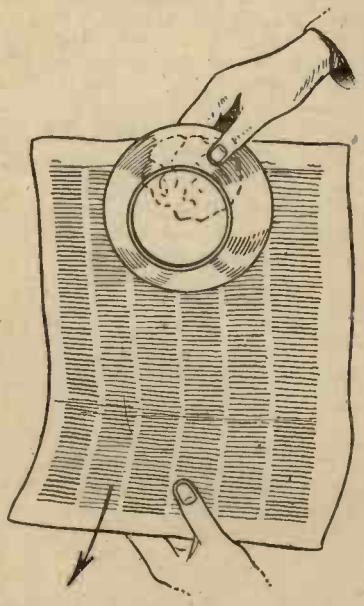


Fig. 8.—How the handkerchief is secreted in the plate.

over to conceal the design. The bottom of the tray being towards the audience the movement of the flap is entirely hidden. The folded handkerchief is now placed on the tray, the surface of which is kept sloping a little away from the spectators to prevent their noticing too soon that the tray is blank. The rest of the trick is simply a matter of showing the tray to be plain and shaking out the handkerchief with the design on it.

An Important Detail

There is an important detail about the construction of the tray which I should like to point out. If you cover the tray and flap with American cloth glued down tight you will find that a noticeable crease is made where the flap hinges. Also the action of the flap will be impeded. The right way to do the job is shown in Fig. 3. The American cloth, in one piece, is glued at each end to the tray proper and by the centre to the edge of the flap. The glue should be carried in only an inch or two leaving the majority of the fabric unattached. It will now be found, if the fabric has been carefully adjusted, that it will fold under the flap on one side while the visible side will be stretched taught. Also the fabric, instead of hindering the action of the flap will now tend to quicken it.

Several other effective tricks can be performed with trays made on this principle. The design on the tray can be made to change colour, or change to another design, by having a different design on each side of the flap. Or again a chosen card may be seemingly caught on the tray from the pack thrown into the air. For this purpose the card would have to be forced, as described in my last article and a duplicate card would be stuck with a dab of wax to the tray under the flap. The card having been returned to the pack the pack would then be offered, on the tray to a member of the audience with the request that it be thrown into the air. As the cards scattered the conjurer would plunge the tray among them, turning the bottom of the tray towards the audience for a moment as he released the flap and so exposed the card.

Messages Written in Chalk

In the same way messages written in chalk could be made to appear written on the tray, by being written before hand under the flap or the entire tray would be made to change colour by the simple means of painting the part under the flap a different hue from that above it.

From hinged flaps we now come to loose flap. In this case a deep plate is used for the trick, which is a version of a very old but always popular illusion.

Briefly the effect consists in magically passing a handkerchief underneath a soup plate which has been inverted on the table. There are several methods of performing the trick, some necessitating very mechanical plates and others depending on sleight of hand. The method illustrated in Figs. 6 and 7 is one which I used in a programme of Chinese magic.

The plate in this instance is of tin enamelled white and decorated with a Chinese pattern. About a quarter of an inch from the bottom of the plate a wire ring is soldered to make a slight ledge in the plate. On this ledge rests a loose disc of tin nicely within the plate. This disc is painted to match the bottom of the plate and the reverse side is covered with news-

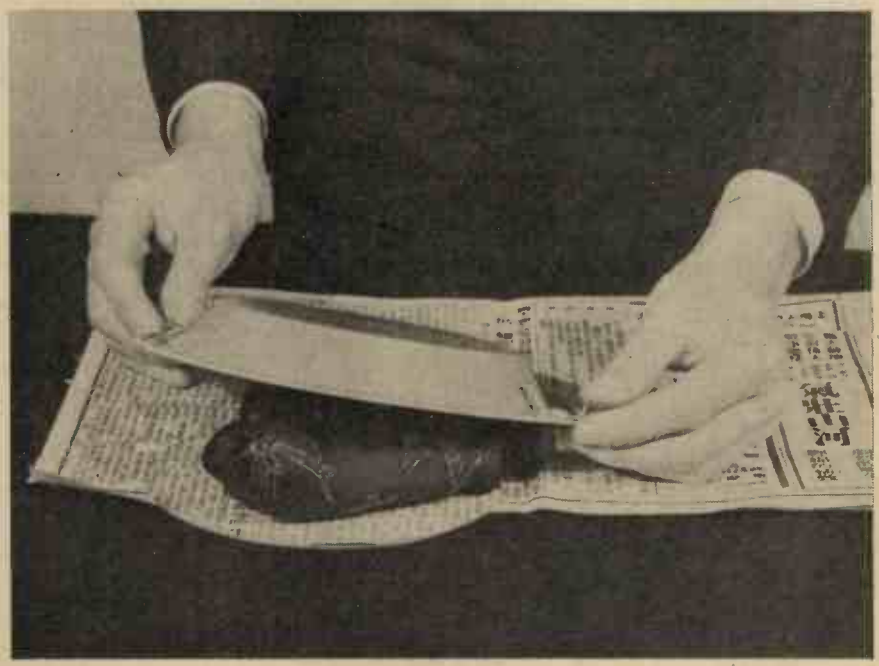


Fig. 7.—The disc released from the plate falls on the newspaper where, being covered on the back with similar paper, it is invisible.

paper. If you can get a Chinese newspaper so much the better, but it makes no difference to the result.

Producing the Handkerchief

In practice the handkerchief to be produced under the plate is concealed under the loose disc, lying compressed between the disc and the plate proper. It may be held in position by the fingers pressing it against the wire ledge already referred to, but in that case the plate would have to be brought on from behind a screen when the trick was to be shown. A more satisfactory method is to fit two small catches as shown in Fig. 7 to hold the loose disc in position. These are simply pieces of wire bent to shape and sliding in bearings made from pieces of a small hinge with the pin removed, these being soldered to the under side of the plate rim.

To set the trick compress the handkerchiefs into the plate, press the disc on top, design side upwards, of course, and slide the catches in to hold it. Thanks to the wire rim underneath the disc it will be firm and steady. In this condition the plate can be freely shown and even thrown into the air and caught again, (the latter part is rather important) without revealing its secret. A piece of newspaper is then spread on the table and the plate laid upon it, upside down. The catches are drawn

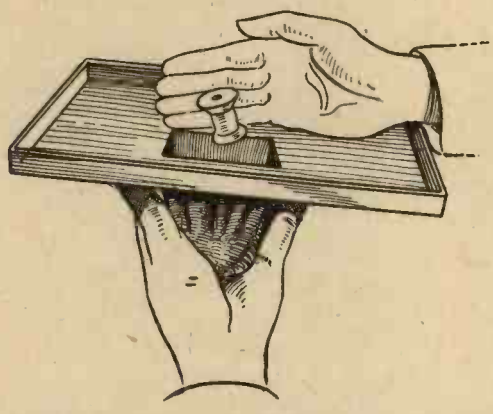


Fig. 10.—Vanishing a reel of cotton into the well of the "black art" tray.

back and the disc falls, leaving the handkerchiefs ready to be revealed when desired.

Fig. 7 shows the catches being drawn back and presents an exposed view of the flap. As will be seen the newspaper covered side is quite invisible against the paper on the table. I have had it photographed projecting off the paper purposely in order to show its position.

Vanishing the Duplicate Handkerchief

The vanish of the duplicate handkerchiefs can be accomplished by means of a double ended canister described in my last article, or with a vanishing pull explained in my article "The mechanics of vanishing tricks" in an earlier issue. In my own programme, instead of handkerchiefs, I use

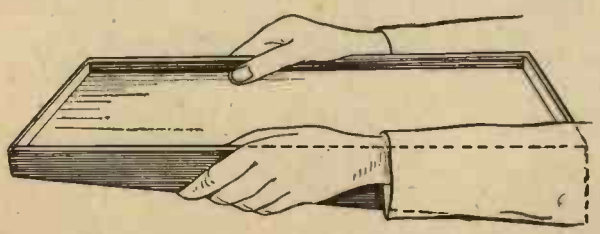


Fig. 11.—Tray with sloping base which is concealed by assistant's arms.

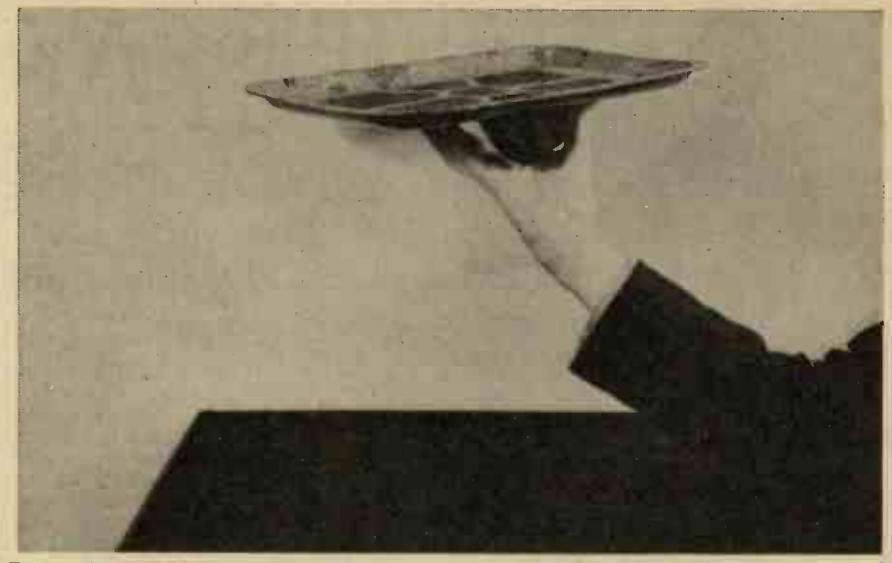


Fig. 9.—A "black art" tray. The open trap in the tray is masked by the pattern on the tray while the fingers of the hand holding the tray conceal the bag from view.

two strips of silk eighteen inches by six, one yellow and one blue, with Chinese characters painted down them.

A simple method of producing the same effect without the use of a prepared plate is demonstrated in Figs. 5 and 8. In this method the handkerchief to be produced is bunched up and held behind a sheet of newspaper. An ordinary soup plate is shown in the other hand. The plate is placed upside down on the paper where the hand is holding it and the paper is then drawn away by the bottom edge and shown on both sides. The effect to the audience is that they have seen plate and newspaper freely displayed. The paper is then spread on the table and the plate laid on it with the handkerchiefs already secreted beneath.

The Black Art Table

In Fig. 9 is illustrated an adaptation of the black art table which I described in a previous article of this series. The principle is that a hole may be cut in a table top and a bag of black velvet fitted underneath, this open trap being invisible by artificial light if the table top is also covered with black velvet and the edges of the trap are masked in a design of bright coloured lines intersecting the top. The tray shown here is fitted with a small edition of the same sort of trap. The top is painted dead black with a bright pattern. One of the spaces in the pattern is the open well. As there is of course no hanging cloth to hide the bag of the trap, some means must be found of masking it from the view of the audience. This is conveniently managed by having an assistant to hold the tray waiter fashion on the finger tips. As long as he does not hold it in front of a light or a pale background, the bag is securely hidden behind his fingers. Small articles may be vanished easily with his tray in the following manner. The article, say a reel of cotton, is placed on the tray in front of the trap. The hand is cupped round it, back of hand towards spectators, and the reel is gently tipped into

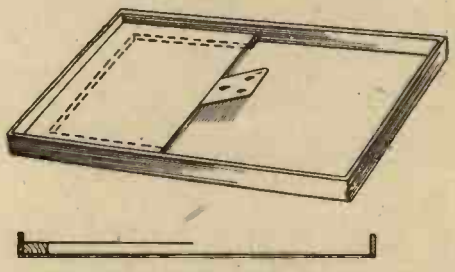


Fig. 12.—Tray with "tunnel" for vanishing cards or coins.

the bag. The hand is then carried away closed as if containing the reel which, after passes have been made with the other hand, is opened and shown to be empty. (See Fig. 10.) This vanish could be accomplished by the performer alone, by holding the tray on the tips of the fingers of the left hand and apparently picking up the reel of cotton with the right.

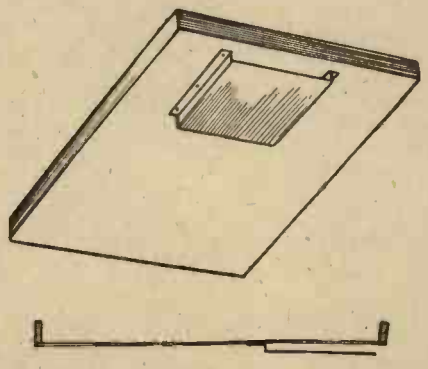


Fig. 13.—The tray with a space beneath for coins or cards.

Another Tray

Another type of tray used frequently for vanishing articles is explained by Fig. 11. The tray is in reality a shallow box with a sloping floor. At the front the tray is little more than an inch thick but towards the back it deepens to about three times this amount. A light coloured moulding round the tray conveys the impression of a thin tray while the slope of the sides is hidden by the arms of the assistant holding the tray. The under side of the tray being dead black effectually prevents the slope being noticed. A tray of this kind can of course be fitted with traps or concealed

(*Continued on page* 117)

THE MONTH IN SCIENCE AND

A baby "tank" which is driven by a 5-h.p. motor and is capable of navigating any type of country.

£20,000,000 World Fair

TWENTY-NINE countries, including Great Britain, have already undertaken to be represented at the New York World's Fair to be held in 1939. Every country in the world—sixty-five in all—have been invited by President Roosevelt to take part, and in addition to twenty-nine acceptances, a further eleven nations are listed as "assured." Fifty million visitors are expected to be attracted to the Fair. The site of the Fair, which covers 1,216½ acres, is on Flushing Meadows, New York City.

A Stratosphere Attempt

THREE Russians recently made an unsuccessful attempt to ascend into the stratosphere. The balloon, which ascended from a field near Moscow, had reached a height of only 2,500 ft. when a leak became evident and they had to descend, landing about half a mile from its starting-point.

A "Sailing" Parachute

M. DENOIS, head of the French School of Parachutists, recently, by means of a special parachute of his own invention, "sailed" for more than 17 miles over the English Channel. The Frenchman took off in a plane from St. Inglevert aerodrome, and when 15½ miles out at sea, north-west of Cape Gris Nez, he jumped from a height of 13,000 ft. and "sailed" gently towards the French coast. The apparatus used for carrying out this feat is somewhat similar to an ordinary parachute, but has secret appliances for opening and "sailing."

Airport Improvements

IT is contemplated building a central control building at the Kingsford Smith airport, at Mascot, Sydney, at an estimated cost of £51,000. The building will be the first of its kind in Australia, and will be of two stories. The ground floor will occupy 15,116 square feet.

"Pennies from Heaven"

A METEORITE has recently been unearthed in the Komarinsk district of White Russia, weighing about six hundredweight. From a preliminary examination it would seem that the main body probably weighed several tons. A further meteorite also made its appearance at Watford at the beginning of this month, when it fell into the yard of a flooring company. These are mere flea bites compared with that which fell near Canyon Diablo, in Arizona, thousands of years ago. It produced a crater nearly 600 ft. deep and 1,500 yards wide, displacing 200,000,000 tons of rock. Then again there is the fragment of meteorite, exhibited in a New York museum, that was found in Greenland. The weight of this so-called fragment is 37 tons. If you should have the luck to find one of these "bolts from the blue," you should get into touch with Dr. Harvey Nininger, of Denver, Colorado, the world's most persistent chaser of meteorites, who is willing to pay 4*s*. a lb. for them.

Not So Dusty!

IT will be decidedly out of place to mention "dusty tomes" in the new university library which will be opened in Copenhagen this autumn. The reason for this is that a method has been perfected by engineers of preventing dust entering the building. Special apparatus has been installed capable of sucking cleansed and dust-free air into the library. Once inside the building, it will be kept at a higher pressure than the outside air, so that when a window is opened, dusty air cannot come in.

The only door in the building will be controlled by photo-cell apparatus.

New German Airship

THE new German airship, LZ130, is now nearing completion at Friedrichschafen, under the direction of Dr. Hugo Eckener. Further details concerning its size, etc., are not yet to hand.

A New Radio Station

CANADA are considering the construction of a short-wave radio station at Ottawa. Mr. Gladstone Murray, general manager of the Canadian Broadcasting Corporation, recently pointed out that Canada is the one important world power unequipped to participate in world broadcasting on the short-wave band. What was required was a short-wave transmitter of 50 kilowatt power to bring the Dominion into line with other countries.

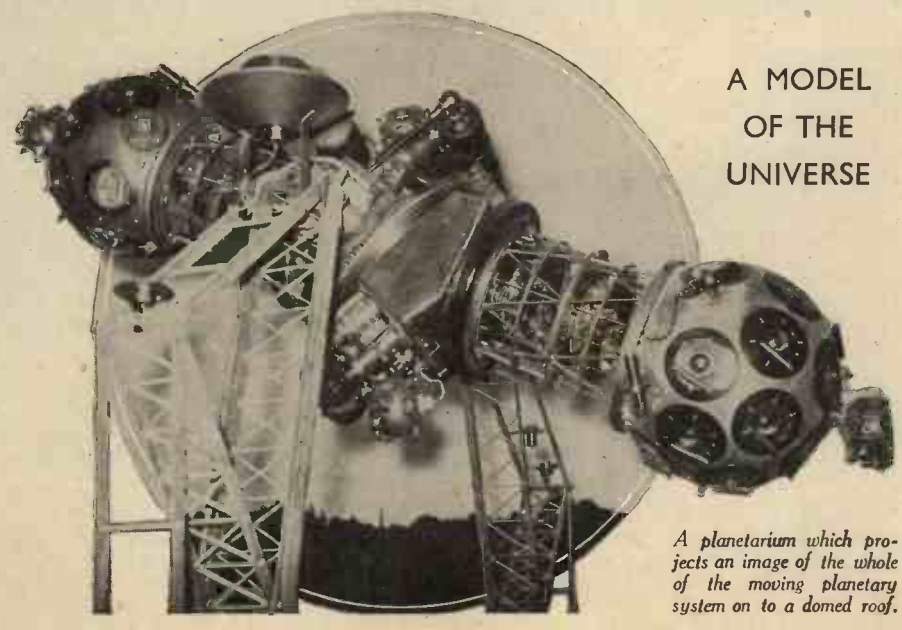
Looking Ahead

WARSAW have now decided on the plans for its underground railway. Stations and fares have been decided upon and 35 miles of line have been traced. But it is estimated that the construction will take 35 years, so the city will not have its railway until 1972.

Cells of Death

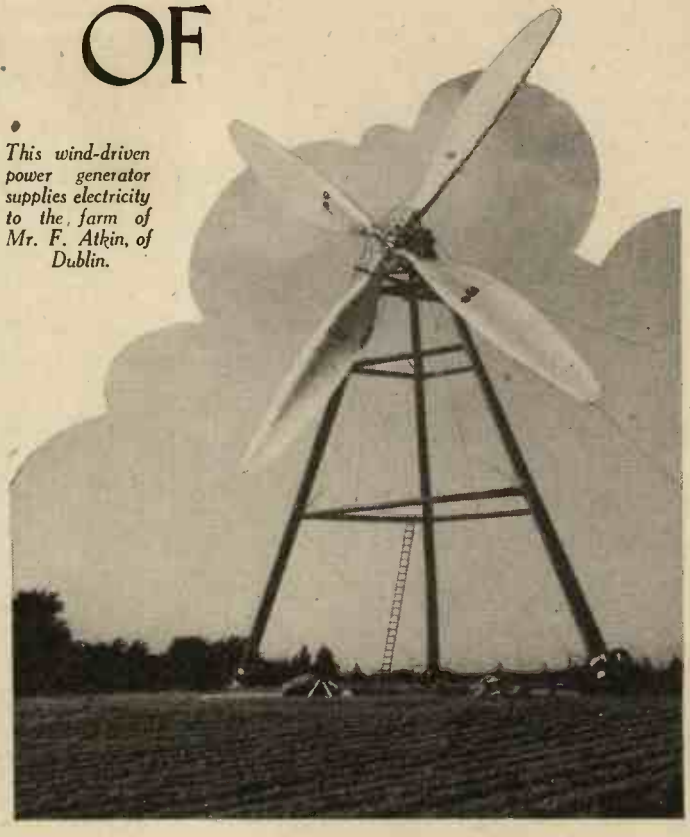
CELLS in the blood-stream which foreshadow death have been described at Portland (Oregon), by Dr. Edwin E. Osgood,

A MODEL OF THE UNIVERSE



A planetarium which projects an image of the whole of the moving planetary system on to a domed roof.

THE WORLD OF INVENTION



This wind-driven power generator supplies electricity to the farm of Mr. F. Atkin, of Dublin.

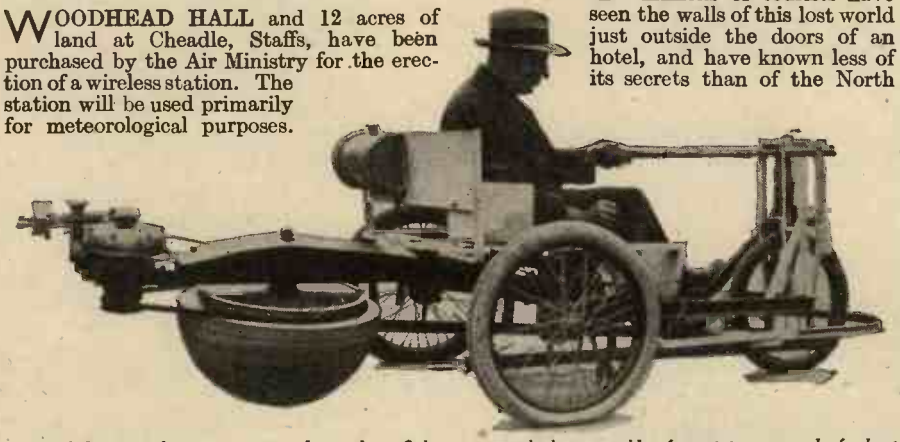
Professor of Experimental Medicine at the University of Oregon Medical School. The cells are normally present in the blood-stream, Dr. Osgood says, but they take on a granular appearance when death is near. He states that death was correctly predicted in 90 per cent. of more than 100 consecutive cases by the appearance of the cells.

A New Name for a Sphinx

YET another name has been found for the Sphinx of Gizeh, which is already known by the names of Hu, Horus of the Horizon, and Harmachis. Its latest appellation is Heren or Horna. The name was found written on tombstones at Gizeh by an expedition of the Egyptian Antiquities Department. Drawings of the Sphinx and Pyramids were found on the tombstone. The new name is believed to be linked with that of the ancient city of Pithom, one of the "treasure cities" supposed to have been built for Pharaoh by the Hebrews.

Further Outlook. . . .

WOODHEAD HALL and 12 acres of land at Cheadle, Staffs, have been purchased by the Air Ministry for the erection of a wireless station. The station will be used primarily for meteorological purposes.



A wheeled spherical motor carriage driven by a 3-h.p. motor which is capable of attaining a speed of about 45 m.p.h.

Curing Drug Addicts

AMERICAN scientists, in their endeavour to find cures for drug addicts, have had remarkable results with experiments carried out on chimpanzees. It has been found that the chimpanzee is the first animal capable of taking morphine like a human being and of reproducing all of man's reactions. Dr. Spragg, of Yale laboratories, who has carried out the experiments, stated that chimpanzees, whilst under the influence of morphine, were in many ways more like human beings than usual. They would scream and fight with rage if the injections were not continued once they had been started. They learned, he says, to pick up the syringe and offer it for use on themselves. The animals were cured of the craving for the drug by methods of withdrawal similar to human beings. He said that persons would have to consider basic and organic factors more than ever before, if they wished to understand the reasons for morphine addiction.

A Lost World

CONSIDERABLE interest is at present centred on the efforts of an expedition to discover the lost world on top of the Grand Canyon Plateau, Colorado, which was cut off from the rest of America 100,000 years ago by erosion. Dr. Andrews, who is in charge of the expedition said: "It is a strange thought that millions of tourists have seen the walls of this lost world just outside the doors of an hotel, and have known less of its secrets than of the North and South Poles or the depths of Central Africa."

A Watch Test Record

AN Omega pocket watch achieved a remarkable result in the 1936 timing tests carried out at the National Physical Laboratory, Teddington. It has created a record by obtaining a total of 97·8 marks. The previous highest award was obtained by another Omega watch in 1933, when it gained a total of 97·4 marks.

Wind-driven Power Generators

IN our September issue of PRACTICAL MECHANICS we mentioned that wind-driven power generators were being installed in U.S.S.R. Mr. McCaffrey, of Dublin, has sent us an interesting photograph, which is reproduced on this page, of a new type of windmill fitted with streamlined propeller rotators, which is erected on Mr. Atkin's farm in Ireland. This wind-driven power generator supplies electricity to the farm, and is believed to be the only one of its type in Ireland. Mr. Atkin, who is the Irish Free State Minister for Defence, certainly believes in labour-saving devices on his farm. The cows are milked with an electrically-controlled machine, and all agricultural equipment, such as root cutters, for preparing food for stock, is run by electricity generated by the winds which sweep down from the Dublin mountains.

"Flying Wing" Aircraft

MR. F. F. MOTE, a Brighton engineer, has invented and patented a new type of "flying wing" aircraft. The design incorporates an inner wing floating in an outer casing, and in the event of a crash, it is claimed that the passengers and crew will remain unarmed inside the inner wing, the shock of impact being taken by the outer shell. The aeroplane will be 150 ft. in span, and the wing will be up to 60 ft. wide. The plane will be about 12 ft. deep for most of its length, with rooms for the crew, passengers, and engines. The main feature of the invention is that where the engines are each of not more than 1,000 h.p. and where the normal cruising speed may be 250 m.p.h., the "flying wing" will be able to cruise at 350 to 400 m.p.h. without using more horse-power.

A Gliding Record

A NEW world height record for a glider flight with passenger has been set up by Herr Ziller, the German instructor, which is more than double that of the old record. Fifteen thousand feet is the height he has

claimed to have reached in his glider. It is stated that the former record stood at about 7,000 ft.

A Remarkable Lens

THE fastest lens in astronomical photography, known as the Rayton lens, was recently used in conjunction with the 100-in. telescope at Mount Wilson Observatory, for taking photographs of spectra of very faint extragalactic nebulae. With the aid of this 100-in. reflector, the new lens, remarkable for its speed of F/0·59, has succeeded in photographing spectra of nebulae 30,000 times fainter than the faintest star visible to the naked eye. Recent data have placed these nebulae at an estimated distance of 80,000,000 light years from the earth. Thus states Dr. Humason, who took the photographs. The lens is mounted at the end of the extension of the telescope, turning slightly upwards.

Streamlined Destroyers

THE United States Navy are to have streamlined destroyers in the near future. This new design is to be incorporated in twelve destroyers to be launched in 1939. The forecastle decks, which will have a slight camber, will be rounded at the edges something like a modified "whale-back" deck.

The structure of the bridge will be symmetrically curved to lessen wind resistance. The design may result in a slight increase of speed.

The Automatic Telephone

THE Post Office hope that by 1941 every one of the 250 exchanges in the London area will have been converted to automatic operation. The work of converting every exchange in the London telephone area—which includes considerable portions of the Home Counties—is the biggest engineering task of its kind ever attempted. In any automatic exchange there are literally millions of tiny soldered points, for instance, and many other technical difficulties are involved.

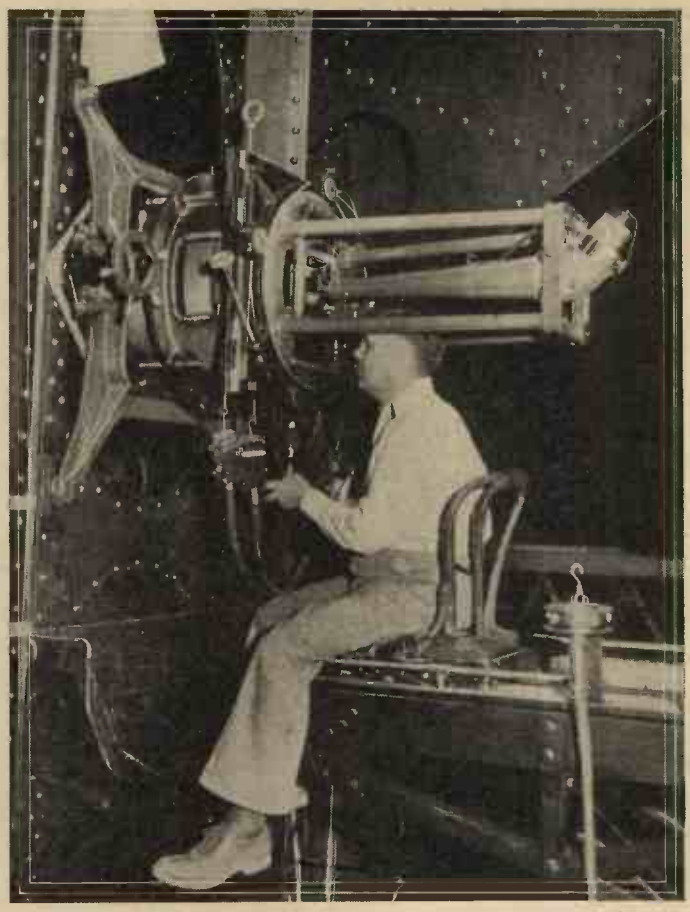
"Waiting for the Bang"

ASTRONOMERS at Mount Wilson, California, have just observed light from an explosion that occurred 7,000,000 years ago and 42,000,000,000,000,000,000 miles away. It appeared as a speck the size of a pinhole. It is known as an exploding star and so rare that only a few have ever been seen. The star was seen in the constellation of Perseus and is the result of an explosion that created a glare 5,000,000,000 times brighter than the sun.

"Wetter Water"

FROM New York State comes the news that chemists have succeeded in producing "wetter water." By adding a new synthetic alcohol to ordinary water it is made "wetter." Anything that the water touches it wets almost instantly. Where ordinary water would take many minutes to saturate certain yarns, they can now be soaked through in a few seconds with "wetter water." One of its most useful features, from the point of view of health, is its capacity for laying dust.

Describing an experiment, the inventor, Mr. B. G. Wilkes, said that an ordinary water spray fell through the air of a room hazy with dust without effect. "Wetter water," however, said Mr. Wilkes, "made the air almost entirely clear and solved the health hazard. The wet water simply soaked instantly every dust particle it touched where ordinary water drops had been "glancing off." The main uses of this discovery are industrial. It can be used for bleaching, mercerising, conditioning cotton yarn and fabric, dyeing and felting wool, and it has uses in connection with leather, paper, pottery, paints, metals, medicines, oils, and cosmetics.



Dr. Milton L. Humason making photographs of spectra of very faint extragalactic nebulæ with the Rayton lens.

Seeing Stars

FOR those readers who are not astronomically minded, an observatory dome is used for housing astronomical telescopes of small and large apertures, and to enable the observer to follow the various stars, etc., by rotating the dome to the required position, either by hand control or electrically. These domes vary from 10 ft. to 40 ft. in diameter, according to the size of the telescope. On this page we show a new form of dome of the roller-blind-shutter type, made by C. E. Mackett & Co., of Brighton, which has the advantage over the older type of shutter used of wide apertures, quick control and cutting out of unnecessary light inside the dome whilst observing.

Also shown on this page is a 16-ft. diameter dome which was constructed in France in 1932. It houses a 12-in. telescope weighing approximately 2 tons and the 50-ft. rack round the base of the dome is driven by an electric motor and controlled by a driving clock, the telescope following the stars all the time.

(Left) The observatory dome built in France in 1932 for studying the stars. (Right) The new type of dome constructed by C. E. Mackett & Co., of Brighton.

FLYING IN A FOG

Guiding Aeroplanes by Wireless

IN cases where fog develops suddenly in the neighbourhood of the London air-port, all air-liners are warned at once by wireless, and a special control-system comes into force temporarily—machines remaining outside a specified zone until they are summoned individually, by wireless, and instructed to fly in and land. This precludes any risk of collision, should several machines be approaching at the same time in foggy weather.

Not only throughout Europe, but also along the Empire air routes, is organised meteorology now at the service of those who fly. From England to Egypt, Africa, India, Malaya, and Australia, big mail-planes now wing their way. Some may be flying through tropical heat. Others may be fighting heavy sand-storms. Others, again, may be combating storms of rain or snow. But at all times, and in all conditions, they have a swiftly-working weather service at their command, flashing its messages and warnings by wireless, and aiding them constantly in adhering to their schedules and in getting through to time.

CARS WITHOUT GEARS

Motor Cars of the Future

THE possibility that both the clutch and gear lever may be eliminated on motor cars of the future has been carried a stage nearer fulfilment by the successful tests which have been carried out over a distance of 30,000 miles of a transmission system invented by a Mr. H. F. Hobbs. The system incorporates a completely automatic epicyclic gear and an automatic free wheel, the only controls being the accelerator and brake pedals. All starting and changes of speed are made merely by using the accelerator.

The mechanical efficiency of the gear is high, being only just under 100 per cent. on the direct drive and over 90 per cent. on indirect drive. The fact that the overall efficiency is excellent is shown by the petrol consumption figures of a 6-ton lorry which has been fitted with the new gear. Before conversion, it consumed 1 gallon to every 6·65 miles, but with the new gear it does 8·76 miles per gallon, an improvement of over 30 per cent. Although the gear is still in the development stage, the results being achieved are very satisfactory and it appears likely that the new system will be widely applied in the near future.

ITEMS OF SCIENTIFIC INTEREST

Fireproof Wood

A NEW treatment by means of which ordinary timber can be rendered efficiently fireproof has been developed by Messrs. Imperial Chemical Industries Ltd. The timber is impregnated with a special compound to which the name "Faspos" has been given. The timber can absorb between 10 per cent. and 15 per cent. of its own weight of the compound and the treatment costs only about 2*s*. per cubic foot.

Petrol Tank Explosions

ON several occasions in recent years, explosions of empty petrol tanks have occurred for no apparent reason. Last April, a serious one took place at Hull, in which three men were killed and the results of the investigation which followed have just been published.

It is believed that the explosion was due indirectly to some water which had been left in the bottom of the tank. The water, which had come from the sea, contained dissolved sulphates and also certain bacteria which are able to reduce the sulphates with the liberation of sulphuretted hydrogen gas. The evidence seems to indicate that the sulphuretted hydrogen attacked the iron of the tank, with the formation of a type of pyrophoric iron sulphide, a substance which is liable to spontaneous ignition due to the heat generated by oxidation.

This somewhat "tall" story would take some believing if it were not for the conclusive nature of the evidence and the subject is therefore an important one for all users of large petrol storage tanks.

Tail Control

MILKING by machinery has for some years been an accomplished fact. An American inventor has devised a new clamping arrangement for keeping the cow's tail in order, during the process of milking. This will prevent the swishing of that appendage which at times must be very inconvenient. We believe that there has been in use a frame to constrain refractory goats whilst being milked. A similar contrivance would be advantageous in the case of a bad-tempered cow.

Coloured Aluminium

A NEW process by means of which aluminium may be dyed with permanent colours has been developed and a new company, Anotints Ltd., has been formed to exploit the process at Hockley Hill, Birmingham.

Although aluminium has been coloured before, the new process, which is an electrical one, is claimed to give a protective covering to the aluminium which becomes an integral part of the metal and is not a form of deposit such as is produced by ordinary plating. The surface of the aluminium becomes an electrical insulator capable of withstanding pressures up to 500 volts and the coloured surface is said to withstand the effects of light and heat.

Another application of the process is being used in America for the treatment of motor car pistons. It has been found that pistons treated with the process require decarbonising less frequently and it is understood that experiments in this direction will be conducted in Birmingham.

NOTES ON PETROL-DRIVEN MODEL AEROPLANES

(*Continued from page* 82)

the hull on to its steps. There are two main steps well forward so that the load may be taken rapidly on to these steps without excessive drag. The angles are fairly fine for a similar reason.

The tail end of the boat hull is not as wide as the forward steps but nevertheless an ample rear step is maintained to prevent the model from having its tail blown into the water when the boat is at rest.

There is a large dihedral angle on the 8-ft. span wing which is divided in the centre for portability. A very large fin at the rear keeps the boat into wind during the take off and when at rest. The hull is of an aerofoil shape so that its large size will not "fight" against the wing. In fact it should assist the air lift, and is placed at a suitable angle to do so. This is where air and water angles do not quite agree but the top of the hull is correct.

The "tail boom" is formed separately from the hull and has the engine nacelle at its forward end. Just behind the engine nacelle there is a platform for the wing. At the tail end there is a platform to take the tail unit which is held in position by elastic bands.

The "tail boom" is also held to the hull by elastic bands to hooks on to the hull. The wing is then held to the "tail boom" by elastic bands. Fig. 1 should make these points clear.

The model takes off in 5- to 6-m.p.h. wind, in about 10 to 15 yards on water with a decided popple. It is estimated that a minimum air speed of approximately 16 m.p.h. is required to lift the boat. Thus the boat on the occasion of its officially observed flight must have been travelling at about 10 m.p.h. over the water with the 6 m.p.h. wind blowing at the time. From observation this would appear to be correct.

A New Design for Grass Shears

AS shown in the sketch these shears enable one to operate them with a one-handed grip. The arrow indicates the direction of grip and thus the hand is at right angles to the cutting surface and not parallel as in the case of normal shears. Another advantage with the shears is that they are less tiring to use. They cost 4*s*. 6*d*. post free.

A novel design of grass shears which can be operated with one hand.

OUR CYCLING CORRESPONDENT TELLS YOU WHAT IS NEW

During Recent Years V
Design of the Modern Bi
Some of the Interesting
Show at the New Earl's C

Raleigh Safety Tourist machine complete with Dyno-hub.

THE Bicycle Show, at the new Earl's Court Exhibition Building, has come and gone, and all the closely guarded secrets of those manufacturers who like to "put something over" on their competitors have now been released to the public. New ideas bristled at every corner and it was a sparkling exhibition in every sense of the word.

Perhaps the two most revolutionary ideas this year were the Raleigh Dyno-hub and the Osgear fixed-wheel derailleur. Both get right away from what has been hitherto accepted as the only possible principle. We have always thought of dynamos as fast-running machines which must be operated from the periphery of a wheel; and we have, in the main, regarded derailleur gears as linked with free-wheeling.

The Dyno-hub

I found the Raleigh Dyno-hub a fascinating device. In appearance it resembles a hub brake, chromium plated, and it is therefore as "integral" with the wheel as any dynamo could be, for it *is* the hub. And as the wheel turns, however slowly, it generates sufficient current to light the lamp.

The principle of the dynamo is a large number (20) of magnetic fields, each of very low resistance, so that in turning the wheel, when the lamp is switched on, it is only just possible to feel a faint pull as the armature cuts across each field. To illustrate how feeble and almost negligible is the resistance, let me say that I tested it when the machine was suspended. The weight of the valve "floated" the wheel between one impulse and the next, of course, and that same weight was almost, but not quite sufficient to carry the wheel past the impulse. The merest touch of a finger helped the wheel over each of the 20 points of generation.

This means that the wheel, even when the lamp is switched on and the dynamo generating, is as free as an ordinary hub adjusted closely such as many riders, including racing men, like to have them.

The Raleigh company naturally foresaw that the public might be uneasy at the thought of using even only one 250th of a h.p. (the rated output of the dynamo), for daylight riding when the current they generated would be running to waste. This objection has been overcome by the ingenious switch which neutralises the impulses. An official of the company told me that they have not yet found a machine sensitive enough to record the "friction" of their switched-off dynamo in relation to that of a plain hub. They admit that it might be something like one two-thousandth of a h.p. It didn't feel as much as that to me!

Generates 12 Volts

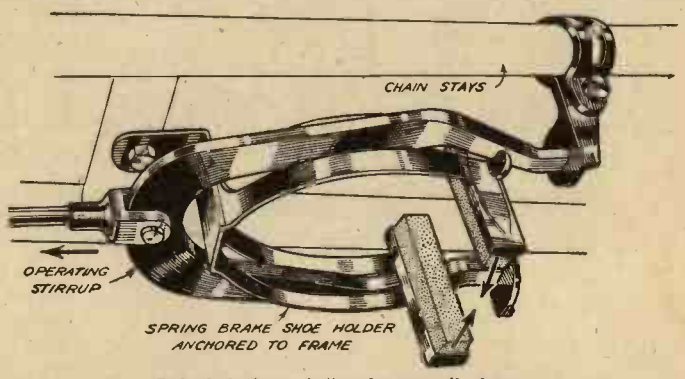
The dyno-hub generates and the lamp lights when the bicycle is being walked.

The strength is 12 volts, and a screw-in bulb of 12 volts ·25 amps is provided, giving a 3-watt light. These bulbs have not, previous to the show, been very easy to obtain, for their applicability was limited to one small motoring purpose.

Of course, the question of weatherproofness will arise with a dynamo placed so much nearer the ground than has been usual. On this point the makers give the utmost assurances. I understand that the outfit has been tested in a state of complete immersion. I have also been told that it has been deliberately filled with water, and that it continued to generate! This sounds truly remarkable.

On the photograph it will be noticed that there are two terminals. These are not, as might be assumed, for front and rear lights. No rear lighting is included in the design for the present. But as the body of the dynamo does not make direct contact with the frame of the bicycle except through the film of oil in the bearings, some direct earthing contact is necessary, and the two-wire system is therefore employed, giving a return from the lamp to the dynamo, and thus completing the circuit.

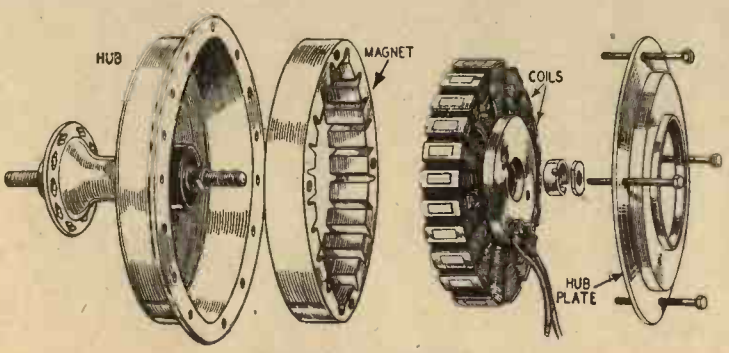
Among several other Raleigh innovations I liked particularly the new brake on the self-intensifying principle. No doubt this brake, and the dynamo as well, will be developed and get wide application in the latest range of cycles produced by this firm.



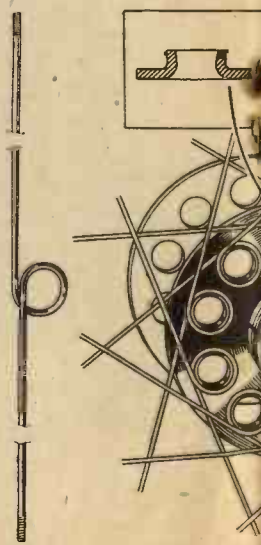
Raleigh brake with "wedge-action" shoes.

A Fixed-wheel Derailleur Gear

As to the Osgear fixed-wheel derailleur, which the Constrictor Tyre Company are handling, I found a huge crowd of keen clubmen besieging it so that it was difficult for mere gate-crashers like myself to get a peep during public hours. The problem has been attacked by a second tension-arm mounted above the chain-stay which reduces the back-lash of the chain to a minimum in back-pedalling. It worked very well in demonstration with a single sprocket, and Mr. Bane, of Con-



The Dyno-hub "exploded."



IN CYCLING

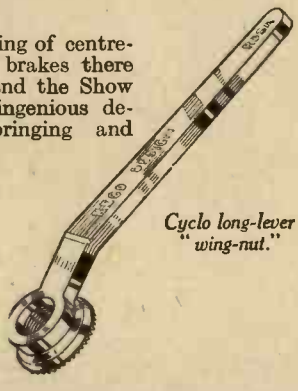
ast Improvements have Been Made in the cycle. Below our Cycling Expert Describes Gadgets Introduced at This Year's Cycle Court Exhibition Building.

strictor's, quickly saw that a slight sideways "run" on the tension-sprocket would assist the smoothness of the change when three sprockets are in use. This alteration is being made, and the fixed-wheel derailleur will then face the test of the hard-rider on the road.

It is not claimed as a new idea, and I know that derailleur makers have experimented with kindred devices. We shall now see whether the ingenuity of the Constrictor concern can succeed with something hitherto regarded as impracticable. Whatever the future for this gear, however, the fact remains that the clubman's outlook on fixed-wheeling has undergone a change in the past few years. The keen men are now quite happy to ride free-wheels if necessary, except in short-distance races. Maybe the advent of a fixed derailleur will help to swing them back to the fixed idea.

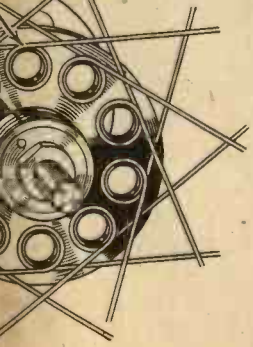
Brakes

Of the making of centre-pull caliper brakes there was no end, and the Show was full of ingenious designs of springing and levering, as well as adjustment. So far as adjustment is concerned the eye was instantly taken by the Webb brake, with its two knurled nuts which, I suppose, could be operated by the rider while on the move. I mention this as an indication of the extreme ease and accessibility of the adjustment—not because anyone would want to adjust a brake without dismounting, unless he was a racer engaged in a short-distance trial. The new Aberdale brake was also worth more than a glance.



Cyclo long-lever "wing-nut."

Constrictor wheel built with double-length spokes, to prevent spoke breakage.



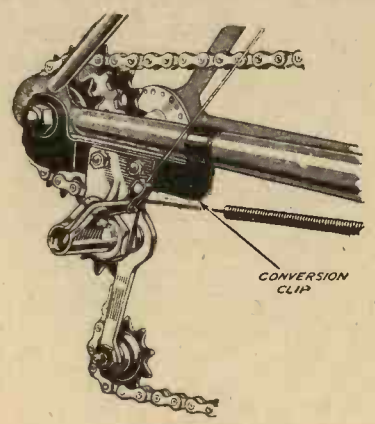
Another new brake of the centre-pull type was the Whitmill, a TriVelox product, in which the arms are drawn up in two converging guides. I was impressed by the neat and clean, but sturdy, lines of this brake. The lever can be adjusted to suit the bend of the handlebar—a very useful arrangement, enabling the brake to be fixed in the best place, instead of, as sometimes happens, the place having to be chosen to suit the bend.

Raleigh lamp for Dyno-hub.

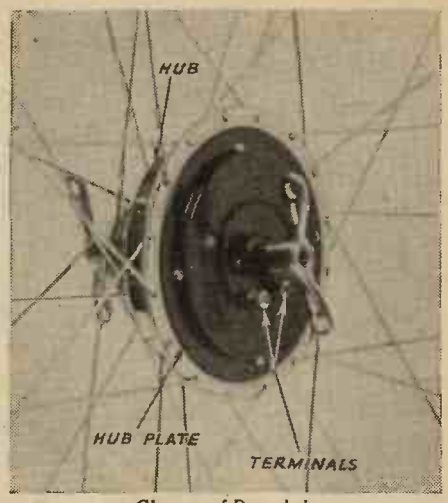
I was shown round the TriVelox stand and saw a demonstration of the two new derailleur gears—models B and C. They are the outcome of the modern habit of companies who have a specialised product, making one on standard lines, as well. Thus TriVelox, who are proud of their derailleur gear in which the sprocket is always in alignment with the chain-wheel, have marketed these B and C models which operate in the orthodox way—the sprocket remains stationary, but the chain is moved over. The jockey arm is fitted with two sprockets, as also is the TriVelox model A.

Cyclo-gears

Speaking of derailleur gears naturally brings us to Cyclo, the pioneers of the chain-gear in this country. Cyclo have followed the practice I have just referred to, of producing something against the principles of their own specialised article. In this case it is the single-wire-control derailleur. They have now marketed one—the Sinclo—to show how well they can do it if they like, but nevertheless they still advocate their own dual-wire gear, which never fails to engage and operate even after the roughest



New TriVelox B model.



Close-up of Dyno-hub.

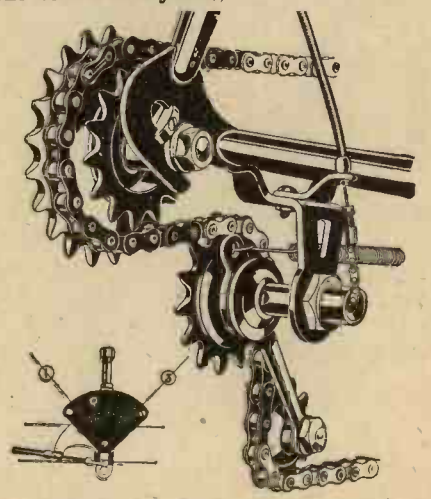
usage. And no race in the world gives a gear such a testing as does a couple of days on a Show stand, esposed to the unmerciful ham-handling of every passer-by.

The Rosa jifadjust handlebar, in which the bend can be turned in the lug and tightened by means of a wing-nut while the rider is at full speed, is symptomatic of new speeding-up of adjustments which I have referred to in connection with brakes. We see it again in the new long-arm "wing-nut" on the Cyclo stand. The arm is cranked to avoid the chain-stay. (The Campagnola lever-nut by Fonteyn is another form of it.)

New Spoking System

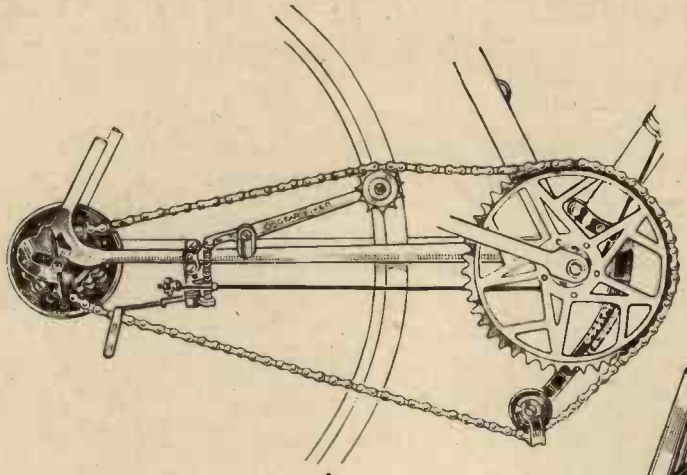
Constrictor had a very interesting spoking system for one or two special wheels on show. The spokes are continuous from rim to rim, as in the case of last year's Saftispoke, but instead of passing through a hole in the hub-flange they are taken round a stud or projecting rim in the flange. Wheels spoked in this way have been tested under pretty rough conditions, and they have remained perfectly true and lively, while the spokes have refused to break. I think there is something in the makers' claim that under this system the spokes are virtually unbreakable. There are no sharp bends or kinks to weaken the spoke, nor any cutting edges to chafe through the wire.

Recent events have shown that the trade do not take kindly to the continuous-spoke system, but Constrictor's have a knack of finding the connoisseurs who like the best of everything.



Cyclo single-wire derailleur. (The Sinclo.)

SOME OF THE MANY INTERESTING ITEMS EXHIBITED AT THE CYCLE SHOW



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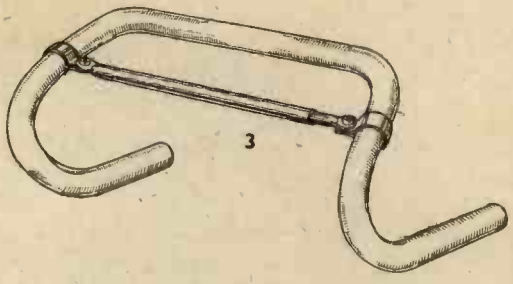
1. Constrictor Osgear with fixed wheel. The chain backlash is taken up by the additional tension arm above the chain-stay.
2. Whitmill brake, made by TriVelox.
3. Handlebar-bag-carrier (Holdsworth).
4. The Lucas tail light adaptor.



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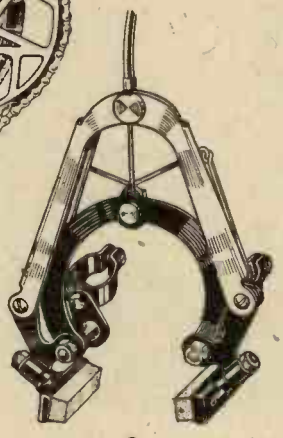

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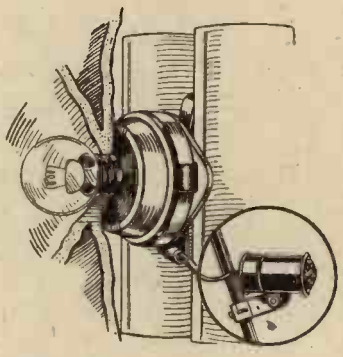

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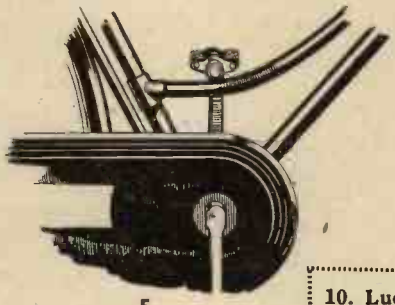
5. B.S.A. Keep Fit ladies' model. The feet, when dismounting, are well clear of the frame loop.
6. Cyclo twist-grip control for change-speeds.
7. Albion non-slip brake block.



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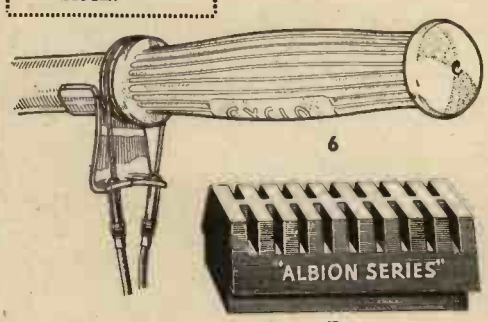

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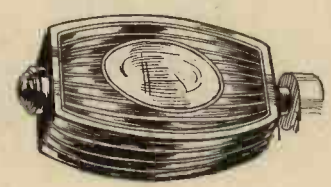
10. Lucas lamp with one-piece rubber shock-absorbing back and battery buffer.
11. A combination letter-lock lamp-bracket (The Guardian).
12. A solid rubber pedal—the Rudge-Whitworth.



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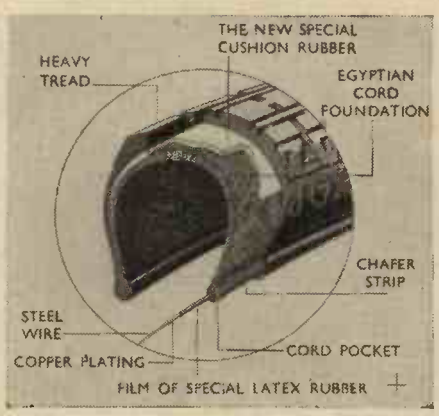

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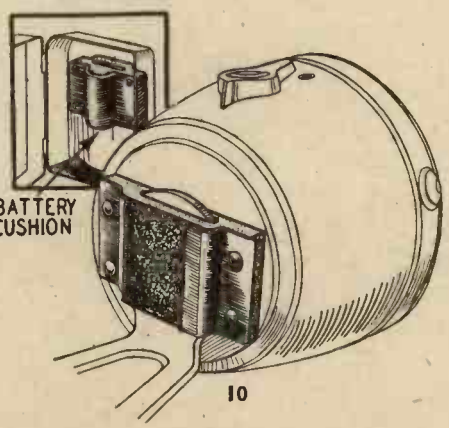

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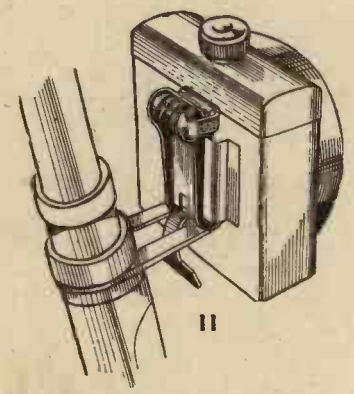

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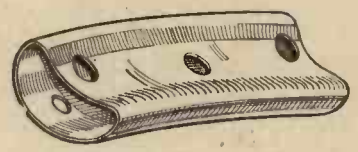

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8. John Bull tyre with cushion rubber layer under tread.
9. Constrictor light steel rim, new pattern.

MAN OR MACHINE?

Whatever the Ultimate state of Civilisation may be, it is not Difficult to Prophesy the Eventual Physical State of Man Himself

5,000 *years hence ?*

IT is always a fascinating occupation to ponder on the swift-moving changes which are occurring about us daily in the great kaleidoscope of life. New ideas, startling mechanical innovations, and new labour-saving devices, are the headlines in the newspapers of to-day, but ere many months pass they drop into the order of things accepted, and we complacently regard them as part of the everyday order of things as they are.

Where is all this leading to ? What is to be the ultimate effect of the myriad appurtenances which make life and living easier day by day ?

Whatever the ultimate state of civilisation may be, it is not difficult to prophesy what the ultimate physical state of man himself will be.

As recently as four hundred years ago, the average human presented very marked physical differences from his descendant of to-day, and even a casual comparison of modern photographs with the portraits of that period, will prove the fact. The head was smaller, the forehead more receding, the lower face fuller, more pendulous, and the general expression positively bovine, in comparison with the faces seen to-day in every street and town in Europe. Even in the children there is a marked difference, and this is strikingly shown by comparing a photograph of the average modern child of, say, eight years of age, with portraits of children as presented by famous artists of the past, particularly the artists of the Dutch School.

The Dwindling of the Human Body

So much for facial differences ; but the bodily attributes show just as great a disparity. The huge feet, great shoulders, massive torso, and bunched muscles have yielded to a comparatively slim, graceful and—in the general run—under-muscled physique. In fact, the human body has dwindled and is still dwindling as the brain increases both in size and power.

No longer are miles of walking necessary, even for the poorest—a luxurious vehicle, with padded seats and shock-absorbing springs, whirls the traveller to his destination for a few coppers. Even at the scene of his daily work, electric lifts relieve him of the necessity for effort. Telephones save innumerable errands, which would otherwise have to be done, and now even the telephone is operated by a "Robot" which eliminates the physical effort of making connection by a human operator. In every walk of life — on the earth, in the air, on and under the sea, mechanism, amazing, ingenious and unfaltering, is steadily making physical effort more and more unnecessary, while mental effort and concentration is being developed at least proportionately. Mechanical advances have been phenomenal in the past century, are now in their full stride, and will continue towards perfection. We venture to prophesy that, in the next thousand years—nay, in the next century, similar progress will be made in psychic science, and that most amazing instrument—though up to now the most mysterious—the human brain, will be the field of advance and discovery. Marvellous as Radio and Telephony are, it is quite within reason to assume that ultimately they may be displaced by Telepathy. In the future, to live even a modest and unassuming existence will involve a working knowledge of physics, electricity, psychology and metaphysics, which would appal the most indefatigable of present-day students.

15,000 *years ago*

The Development of the Brain

The human brain will be the most important part of the anatomy, and indubitably the *most developed, both in power and size.* All of us to-day acquiesce in the hypothesis that man is becoming more and more intelligent, more mentally developed from generation to generation, but how many, who admit at the same time that physical effort is becoming proportionately less necessary, realize the inevitable outcome of these facts.

In the far-flung future, man will indubitably become a very different entity to that of to-day—in fact, it will not be absurd to state that he may develop into a totally different type of creature, consisting of a great brain sustained by a stomach which transforms minute quantities of synthetic vitamins and other nutritious fuel to the great mental engine as required.

Thought—which is known to consist of a radiation of psycho-electric origin—will be so developed that appetites of all kinds will be unknown, and it will be possible to perform all actions and functions and, above all, to control the amazing machinery of the future by thought waves alone.

In appearance we may imagine the Future Man as a huge and sensitive brain cradled in an artificial supporting and mobile chair, the mechanism of which will operate through thought-wave cells controlling relays, just as the photo-electric cell of to-day is controlled by the Infra-red ray. His body will have dwindled to a pitifully infantile form, hands and arms will probably have developed into tentacle forms, while the lower limbs will, in view of the extinction of pedestrian effort, have almost, if not quite, vanished.

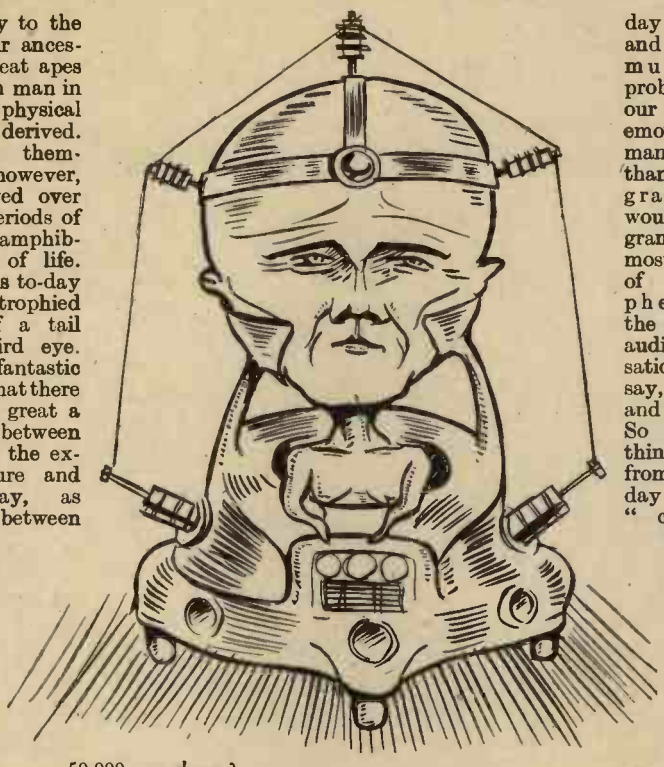
Men Like Machines

Needless to say man will have become almost a part of the machines with which he has surrounded himself, in fact the machines will *be* his limbs and body ; sensitive, cold, calculating and exact ; able to perform the most delicate of operations or unleash titanic energy at a thought.

Did you say "*Fantastic*" ? Think a moment.

The world is still quite young as worlds go ; and it is relatively a mere step from the

present day to the time of our ancestors, the great apes from whom man in his present physical form is derived. The apes themselves, however, were evolved over immense periods of time from amphibian forms of life. We all of us to-day carry the atrophied remains of a tail and a third eye. It is then, fantastic to suggest that there will be as great a difference between the men of the extreme future and present day, as there is between your favourite film star and that blob of ambitious jelly that crawled, after incredible pains and efforts, from a noxious pool in the mephitic depths of prehistoric gloom.



50,000 years hence?

Under our very noses the change goes on, day in, day out, and there is much more probability in our vision of an emotionless human machine, than our great-grandfathers would have granted that most common of everyday phenomenon: the holding of audible conversation between say, London and New York. So many new things appear from day to day that we "cannot see the wood for the trees," and if any of us could be alive in the year 1,000,000, no doubt we would regard the denizens of the year 1937 much as we, in turn, regard the Piltdown Man or the terrific monsters of Palæontology.

A NEW LIGHTWEIGHT PORTABLE

The accompanying illustration gives an idea of the neatness and compact form adopted in the B.T.S. portable to which the name "Little Princess" has been given. The illustration cannot, however, give an accurate idea of the attractive appearance of the receiver, as it is finished in a blue morocco-grained leatherette, and this, together with the silvered escutcheon and chromium bars across the speaker grille lend a most pleasing style to this new receiver. A self-contained aerial is fitted, and the receiver chassis incorporates a 4-valve circuit in which an S.G. valve is employed for H.F. amplification, followed by a triode with reaction which is in turn coupled to an L.F. valve. This is fed, by means of a parallel-fed L.F. transformer, into an output pentode of the Harries type, and the general circuit arrangement has been so designed that the total H.T. consumption has been brought to the low value of 6·5 mA. A 'phone jack is fitted so that headphone reception may be employed when required, and the speaker is then automatically cut out of the circuit. Tuning is carried out by means of a two-gang condenser of the air-spaced type, and the tuning range of the coils fitted is from 200 to 2,000 metres. The left-hand control switches the set on and off and also selects the wave range, whilst the right-hand control governs the volume. A ball-bearing turntable is fitted beneath the cabinet to enable the receiver to be turned easily in order to take full advantage of the directional properties of the frame aerial. An external aerial and earth may be fitted if desired.

The new B.T.S. "Little Princess" Portable.

MAN-POWER FLIGHT

(Concluded from page 43 of last month's issue)

I have built a fuselage the complete weight of which with hand and pedal gears is 9¼ lb., and I have developed a strut and a spar which are lighter than anything I have yet seen. An extremely stiff and strong oval section, 2 in. by ¾ in., weighs less than 1 oz./ft. run, and joints of equivalent strength weigh 0·5 oz. each.

Let us now try to explain the principle of my present efforts in the simplest manner possible. Fig. 5 is an imaginary glider gliding down in the usual way. A man is sitting inside and is winding himself and the fuselage upwards with respect to the planes (this is merely to explain the principle, as, of course, it is nothing like this in the practical mechanism). The combined weight of man and fuselage is, say, 80 per cent. of the total, therefore he must lift this weight approximately 20 per cent. more than the equivalent vertical descent due to the gliding angle. The mechanism then releases the planes, and, by virtue of their lift from forward travel, they rise to 20 per cent. in connection with this last operation.

The particular method of performing all this is immaterial at the moment, and I hope that readers will agree with me that it is perhaps better not to disclose it for the time being. They can rest assured, however, that the action is smooth and satisfactory, and the only question remaining is one of glider efficiency.

A glider must be made to come within the figures I have given above. We know that many gliders can glide over 50 miles from a height of 1 mile (5,280 ft.), probably with the pilots looking for "thermals" all the time. It would be interesting to know their distance in still air from the same height. On the other hand, if a glider can take advantage of ascending currents, we can do the same and can "rest on our oars," always feeling that with a little rowing we can get over the flat spots, and this, I imagine, most gliding enthusiasts would welcome.

I have built a model with a 3 ft. span, and, lifting by reaction as above described, it will jump straight off the ground, carrying four times the weight that can be expected from the usual airscrew-driven model of the same size even when launched by hand.

It closely follows the laws of lift by a crane, inasmuch as twice the power will lift approximately twice the weight.

I have not completely solved the problem of control in the air yet, and I am satisfied that it is a waste of time to try to determine this from a model.

Even with the best of known types of models, it is difficult to get a good flight, and with an entirely new principle the quest is well-nigh hopeless, because one can spend hours in trying some variation in a certain gear, only to find that some tiny alteration of rudder, wing tip, or elevator from the last bad landing has taken away all chance of a comparison.

In a case of this kind it appears essential to have the foresight, control, and immediate action that can only be obtained with a pilot at the helm.

Mr. Lloyd with his "Petrel."

A fine model and its admirers.

MODEL AERO TOPICS

CURRENT NEWS FROM THE WORLD OF MODEL AVIATION

BY F. J. C.

The "Petrel" Contest

I HAVE received a large number of letters from readers who were unable to compete in the above Contest owing to lack of delivery of engines, or because the date was not quite convenient. Since the competition has closed the models have been completed, and I am glad to note that all of them have proved successful. A number of them failed to fit time switches with the inevitable result that the models flew out of sight and were lost, or that they were damaged by collision. Mr. S. J. Crouch of Sevenoaks sends me a picture of his "Petrel" on the ground and in the air. He tells me that he has had about 30 excellent flights from it, powered with a Brown Junior engine.

The S.M.A.E.

A NUMBER of unaffiliated clubs seem to be under the impression that they are able to forward resolutions to the S.M.A.E. Such resolutions are out of order. The Provincial Aero Modellist's Debating Society recently forwarded such a resolution but it was ruled out of order. Such resolutions can only be accepted through affiliated clubs and their delegates.

The Wakefield Cup Contest

WE are asked to state by the S.M.A.E. that through an error of their transcription the sixth place in the International Wakefield Cup Contest should be S. Stark, Sweden, instead of G. Stark, Germany. They offer their apologies for this slip.

S.M.A.E. Competitions

THE following competitions are held annually. The Gamage Cup, the Pilcher Cup, the Model Engineer Cup, the Flight Cup, the Western Cup, the Autogiro Cup, the Lady Shelley Cup, the C.S.S.A. Cup, the Wakefield Cup, the Premier Shield, the Sir John Shelley Cup, the Bowden International Trophy, the National Cup, the Biplane Cup, the Farrow Shield. Full details can be obtained from Mr. A. E. Cosh, 35, Maple Street, Sidcup, Kent. Some of the competitions are decentralised, and these are held on the recognised grounds of affiliated clubs, and the results must be forwarded to the Competition Secretary giving fullest details. Such must arrive by the first post on the Tuesday morning following the competition together with the entry fees received. They must be certified true and correc by two club officials. Centralised competitions are held on grounds which have been selected by the Council of the S.M.A.E. and they are controlled by officials of that body.

Competition Rules

1. NO record flight will be entered into the Society's Books unless officially observed by recognised timekeepers.

2. No trial flights may be made during the five minutes preceding the time appointed for the competition to start, or during the competition. Minor repairs and test flights will, however, be allowed during the competition at the discretion of the Judges.

3. Individual flights (rise-off ground or water) of five seconds or under not

Mr. S. J. Crouch's model "Petrel"—in action and static.

Scenes in the recent "Practical Mechanics" "Petrel" Model Aeroplane Contest.

to count as competition flights; but in hand-launched competitions no extra flights will be allowed.

4. A competitor by entering any competition thereby agrees that he is bound by the regulations made regarding it, and any special rules thereafter issued in connection with that competition.

5. Each competitor must be ready within two minutes from the time he is called. If not then ready he renders himself liable to disqualification from that round.

6. All fuselage models entered for competitions or record-breaking must be fitted with a body complying with the following formula:

Minimum value of maximum cross-sectional area =

$$\frac{(\text{overall length of model})^2}{100}$$

If two or more fuselages are employed, the total cross-sectional area must conform with the above formula.

In the case of fuselage gliders, the formula is as follows:

Minimum value of maximum cross-sectional area =

$$\frac{(\text{overall length of model})^2}{200}$$

7. In competitions and "record-breaking" when flights have been obtained after rising-off ground or after rising-off water, the duration will be taken from the time the air-screws are released (at the commencement of such flights). No push whatever is allowed in such cases.

8. All contests with the exception of International ones must be held on dates fixed.

9. The timing of any flight shall terminate when the machine touches some solid object or passes out of sight, the time-keepers remaining at the point from which the machine is released. Two time-keepers must be employed, each having a stop-watch.

10. When three flights are necessary in any contest the Judges will at their discretion fix a time limit by which each flight must be made.

11. Neither the S.M.A.E. or owners of any flying ground where competitions are held, will be responsible for damage of any kind done to or by models.

12. The interpretation of these regulations or any to be hereafter issued shall rest entirely with the S.M.A.E. Council.

13. The Council reserves the right to add, to amend, or omit any of the Rules should it think fit.

14. In any case of misconduct or intentional breach of the Rules the Judges may disqualify any competitor.

15. The decision of the Judge or Judges must be accepted as final.

16. Entrance fee for competitors or members of affiliated clubs shall be 1*s.* for those over 16 years, and 6*d.* for those under. For non-members in open competitions, the fees shall be 2*s.* 6*d.* and 1*s.* respectively.

Rules for Timing Duration Flights

1. ANYONE attempting to break an existing record need not be a member of the S.M.A.E. (or affiliated club), but his flights must be timed by two time-keepers recognised by the S.M.A.E. and a charge of 2*s.* 6*d.* will be made.

2. All time-keepers shall be members of the S.M.A.E. (or affiliated club) and must be recorded as such in the Society's books.

3. The time-keepers shall each have a stop-watch which shall be started when the machine is released, and stopped when it touches some solid object or passes out of sight. The mean value of the two readings to be taken as the correct figure.

4. The time-keepers shall remain at the point from which the machine is released and no attempt shall be made to follow the machine by any means whatsoever.

5. No optical device such as binoculars, telescope or coloured glasses shall be used to observe the machine in flight; the "out of sight" rule being solely dependent on the time-keeper's unaided eyes.

6. No notice shall be taken of remarks by onlookers as to the visibility of the machine or the termination of its flight.

7. Any claim for a record must be submitted to the S.M.A.E. within one month, for ratification, together with the names of the time-keepers, the date of the attempt, and general particulars of the machine.

8. Gliding attempts may be made from high ground (any place in British Isles) or by any method which permits the Judges being at the position from which the model is launched.

(*Continued on page* 121)

A Puss Moth model fitted with the Bantam engine.

ARE YOU MISSING THIS FINE HOBBY?

These detailed FLYING MODELS are a joy to build

YOU will be amazed and fascinated in the way these kits build up—the special quick-drying cement, firm in 30 seconds, is a real joy to use. They are constructed right on top of the full-size plan which is, of course, given, so that you have no drawing or measuring to do.

GLOSTER GLADIATOR

Wing 18 ins. Length 14 ins. A real beauty with every detail. Auto-line-up fuselage, shock-absorbing undercarriage. Very large clear plan with many working drawings. Absolutely complete kit, cements, lacquers, dopes, etc. Carriage paid **5/-**

Two very easily-built models

PUSS MOTH

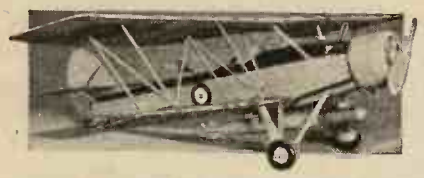
Wing, 16 ins. Mollison's famous East-to-West Transatlantic flight plane—attractive appearance and fine flyer. Kit has all parts needed. Post free **2/6**

MONOCOUPE (Flying)

Wing, 15½ ins. Splendid little model, very easy to build. Complete kit has all parts needed. Post free **2/6**

SPECIAL LEARNER'S KIT BRISTOL BULLDOG

This kit has eight pages of special instructions and illustrations which explain every action and make it impossible to go wrong. It is a very fine exact scale model of the favourite R.A.F. fighter and shows every detail of the real plane, machine guns, petrol tanks, insignia, etc., etc. Kit is complete with everything needed. Carriage paid **4/9**



NEW! BLACKBURN SHARK

Wing, 34½ ins. Magnificent model with shock-absorbing under-carriage and new wing jigs. Very large, clear plan with many helpful drawings, showing swivelling and shock-absorbing tail wheel, rear machine gun, torpedo. Special hand-carved light hard-wood prop which gives a fine performance. Kit is complete with all balsa spars and sheets, wheels, nose-button, quick-drying balsa cement, tissue cement, lacquer for under-carriage, shrinking dope for tissue, printed R.A.F. cockades, and all else needed. Carriage paid **7/6**

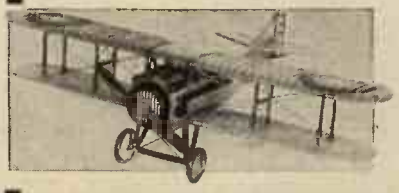
HOURS of PLEASURE

but little expense with these

SOLID MODELS SCALE ½ in. to 1 ft.

HAWKER HART

Wing, 9⅜ ins. Exact scale model of R.A.F.'s best two-seater bomber. Full-size plan is very detailed. Complete kit has everything needed, all wood ready cut to outline, die-cast prop, cement, lacquers, etc. Carriage paid **3/6**



SPAD

Wingspan, 6½ ins. Fine model of Great War fighter. Full-size plan shows every detail. Complete kit has all parts needed, wood ready cut to shape, die-cast prop and Vickers gun, cement, lacquers, etc. Carriage paid **2/6**

MONOCOUPE

Wingspan, 8 ins. Very smart model of American civil plane in cream and red. Full-size plan shows all details. Kit is complete with all parts needed. Carriage paid **2/6**

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(All kits 2/- postage extra for abroad.)

HAWKER HURRICANE

Wing, 20 ins.; length, 15 ins. Movable controls. This Peerless kit makes a beautiful model with good flying performance. Special condensed instructions, four pages. Fuselage jig. Shrinking dopes and cements are included in the complete kit. Carriage paid **5/-**

HESTON PHŒNIX

Very Good Flyer

Wing, 18 ins.; length, 13½ ins. Retractable landing gear with locking control. Very clear, full-size plan. Comet Auto-line-up fuselage. Kit is absolutely complete. Carriage paid **3/11**

MASTERS OF MECHANICS

No. 27.—Alfred Krupp, the One-time "Cannon King."

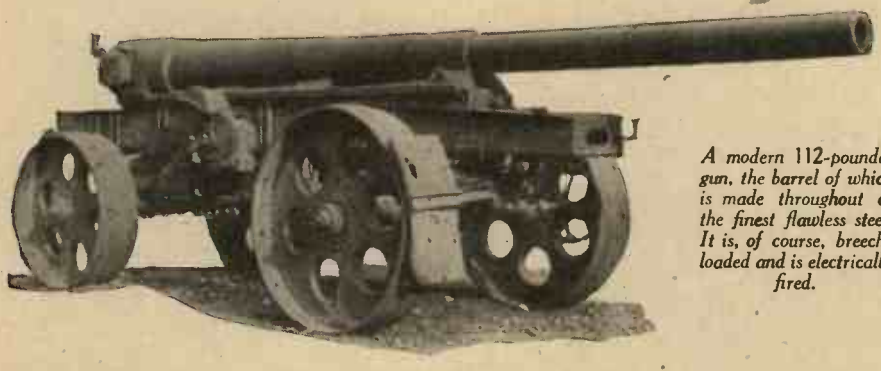
FRIEDRICH KRUPP had been bedridden for close upon two years before his death on October 8th, 1826. The cottage which he occupied was originally designed for the foreman of the adjacent miniature steel works upon whose land it was built, but, for years, Krupp, the proprietor of the foundry, had been its foreman, workman, manager and everything. Business had never been good since Friedrich Krupp, with his small savings, bought that Essen foundry in 1810. And, indeed, although Krupp was hard-working and a conscientious man, an individual who possessed ideas and who cherished the then apparently fantistic notion that steel was an immensely superior material to iron, he never made any headway in his activities. The Krupp steel foundry had become more and more a hopeless failure and, in consequence, the Krupp family had sunk further and further into poverty and debt.

Krupp the elder and the ill-fated left his devoted wife, Therese, with four young children to bring up and with the almost non-existent income derived from his foundry to accomplish the task on. Therese Krupp, however, was a woman of no mean ability. She possessed actual practical experience of foundry work. So much so that, in sheer desperation, she took over the working of the foundry herself after the death of her husband, installing her eldest son, Alfred, as a sort of nominal manager of the concern and somehow or other persuading one or two workmen whom

Alfred Krupp.

deepened in Alfred's mind as he gained more and more practical experience in the working of the foundry.

Krupp the elder had obtained his small requirements of steel from Sheffield, and his son, Alfred, after the Essen foundry



A modern 112-pounder gun, the barrel of which is made throughout of the finest flawless steel. It is, of course, breech-loaded and is electrically fired.

Friedrich Krupp had previously employed to return to their former jobs.

Alfred Krupp

If young Alfred Krupp, then a mere school lad of fourteen years of age, had been an ordinary sort of boy, the world, in all probability would have never heard of the firm of Friedrich Krupp, of Essen, Germany. Actually, however, Alfred Krupp, no doubt in consequence of the spartan life to which he had been accustomed, was anything but an ordinary lad. Naturally serious in disposition, he took upon himself his unenviable responsibility with a good heart although, at that time as he afterwards recounted, he found "more debts than fortune."

Friedrich Krupp had lost practically everything and had died a disappointed man. One thing, however, he transmitted to his son, Alfred, and that was his firm belief in the future of steel, a belief which had again regained a working footing, continued to import the Sheffield-made material—whenever he could persuade the British makers to allow him sufficient credit.

A few years after the death of the elder Krupp, a cousin of the family was induced to invest a little money in the Essen steel foundry. Herman Krupp, a younger brother of Alfred, joined the firm which, owing to its newly acquired capital, was able to avail itself of the services of two commercial travellers. Slowly—ever so slowly, as Alfred Krupp relates—the business grew and became just able to pay its way and to throw off its old and hampering debts.

Business Improves

After ten years of hard work on the part of Alfred Krupp, who, besides managing the technical side of the business, travelled all over Germany for orders, the Essen steel works began to gain a reputation for itself. Such success was almost entirely due to Alfred Krupp, for, with his many other traits he combined that of inventor and besides perfecting his method of casting, steel in considerable quantities, he had devised an improved form of wheel and tyre for railway carriages, the profits from the manufacture of which he devoted almost solely to the improvement and enlargement of his Essen foundry.

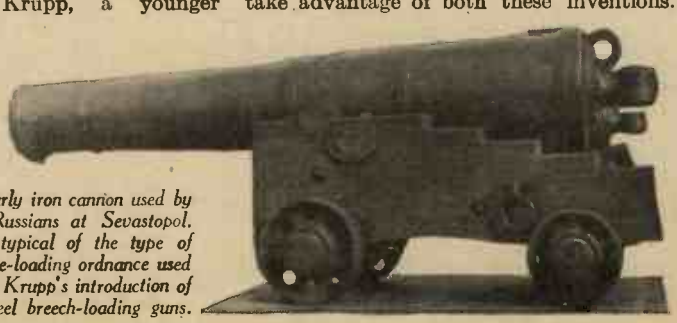
In 1845, when, according to Krupp, the family concern was just payings its way, it employed no less than a hundred and twenty-two workmen. Sheffield steel was no longer imported. In its place, Krupp used steel of his own manufacture.

The first excursion of Alfred Krupp into cannon making took place in 1847, in which year he produced a light muzzle-loading 3-pounder cannon. Previously, all artillery pieces had been made of cast or wrought iron and, in the military opinion of the day, no more suitable material than well wrought iron could possibly be found for cannon construction. Krupp's 1847 cannon, therefore, failed to create much attention in his own or in any other country.

It was not until four years afterwards that Krupp succeeded in awakening the military mind of the age to some appreciation of the possibilities inherent in all-steel ordnance construction. This he did by sending to the Great Exhibition, the prototype of all national and international industrial exhibitions, which was held in London in 1851, his second steel cannon and, also, a solid ingot of cast steel weighing two tons and twice the size of any mass of steel which had been previously cast. Both these exhibits caused astonishment, particularly in the engineering and steel-making worlds.

Heavy Artillery

There is little doubt that the enormous success which subsequently came to Krupp in the manufacture of heavy artillery was based mainly upon two English inventions—the manufacture of steel by the Bessemer process and the invention of the steam hammer by James Nasmyth, of Patricroft, near Manchester. Krupp was quick to take advantage of both these inventions.



An early iron cannon used by the Russians at Sevastopol. It is typical of the type of muzzle-loading ordnance used before Krupp's introduction of the steel breech-loading guns.

He erected the first steam forging hammer in Germany and when, in 1857, the Englishman, Bessemer, devised his steel-making process, Krupp was the first to undertake the manufacture of steel by this celebrated method.

German railway trains were very quickly given axles and wheels made from Krupp-produced Bessemer steel. Steel goods of every description poured unceasingly and increasingly from the Essen steelworks and last, but not least, came the inevitable steel cannons.

Krupp's second and London-exhibited cannon of 1851, was a 6-pounder gun, the barrel of which was forged in one piece. The recognition which it attained, small though it was, encouraged Krupp to give his mind over to one of his pet themes—the construction and development of a breech-loading steel cannon which, so far as accuracy of aim and rapidity of loading were concerned, Krupp saw to be immeasurably superior to the older types of muzzle-loading guns.

Governments, however, are usually notoriously conservative entities and Krupp found them no exception to this general rule. The first Government which succumbed to Krupp's notions regarding ordnance was the Russian one, although, previously, the Prussian Artillery Testing Committee had reported favourably upon his lighter guns. After perfecting his breech-loading cannon in 1859, Krupp, in 1863, obtained an order for a number of these guns from the Russian Government. Other nations quickly followed the example of the Russians and before long guns made of Essen-produced Krupp steel—the finest in Europe at that time—were being imported into all countries. Even the British ordnance manufacturers secretly imported gun barrels of Krupp steel, despite the feeling of prejudice which existed against foreign-produced gun material in this country.

A Letter to a Crown Prince

Krupp, in a letter written to the Crown Prince Friedrich Wilhelm, of Prussia, dated February 27th, 1863, takes apparent pleasure in asserting the undoubted superiority of his steel:

"My gun material," he writes, "is known throughout the world; let the leading English manufacturers themselves decide whether they are in a position to supply its like. The importance of a reliable material requires no explanation, for without this reliability of manufacture, the guns are an instrument of suicide. The English method of manufacture of guns, which are produced by welding, is very precarious and uncertain. The difficulty increases with the size of the calibre. Faults which will bring destruction, may exist unnoticed in the guns, whereas in a crucible-steel gun of my make, which is bored out and clean, no fault can remain. Out of thousands, not one has revealed faulty material."

Krupp was correct in his statement. No flaw was ever discovered in the steel of his guns, and fatalities through the shattering of a gun barrel which, at one time, were not uncommon with the old iron cannons, were totally eliminated in the case of his guns.

To prove the superiority of his steel, Krupp exhibited at the London International Exhibition of 1862, a mass of steel weighing some twenty-one tons. The steel had purposely been broken across in order to reveal its homogenity of texture and its complete freedom from internal flaws.

The Franco-Prussian War

The Franco-Prussian War of 1870 constituted the practical testing period of Krupp's guns. Some of his guns employed during that conflict had a range of five miles—an enormous distance at that time—although their average range for a 600 lb. projectile was not quite three miles.

Although Alfred Krupp drew fame and fortune upon himself mainly by his invention and manufacture of weapons of destruction, his concern for the welfare of the individuals in his employ was, considering the age in which he lived, remarkable. The firm of Fried. Krupp, of Essen, was one of the first to provide its workers with comfortable conditions of labour. It embarked upon the provision of housing estates for them. It equipped schools for their children, provided pension and insurance schemes and entered into all sorts of educational activities on the behalf of its employees.

Meanwhile, the fame—and the fortune—of the Krupp concern increased rapidly. At the Düsseldorf Exhibition held in 1880, Krupp exhibited a steel cannon of over 100 tons weight. This was the first of the world's really heavy artillery and it demonstrated to all concerned the possibility of producing ordnance of massive size and range.

The "Cannon" King

Alfred Krupp, who, by this time, had come to be known as the "Cannon King," found himself one of the most regarded men in Germany. A friendship sprang up between him and William I, of Prussia, who, from his frequent visits to the Krupp factories, was rumoured to be in partnership with the famous steel manufacturer. In all technical developments pertaining to heavy engineering methods and to steel making, Krupp, during the closing years of his life, took a leading part. Ever a man of much decision and of shrewd foresight, Krupp's success was due, in the main, to the combination of these two qualities with his technical and inventive abilities. In the early '80's of the last century, Krupp found himself supplying artillery—light, medium and heavy—to nearly every government in Europe. Krupp steel was in demand everywhere. The various Sheffield steels were, it is true, finer and more resilient n texture, but for gun manufacture the Essen-produced steel of the Krupp factories was held superior to any other.

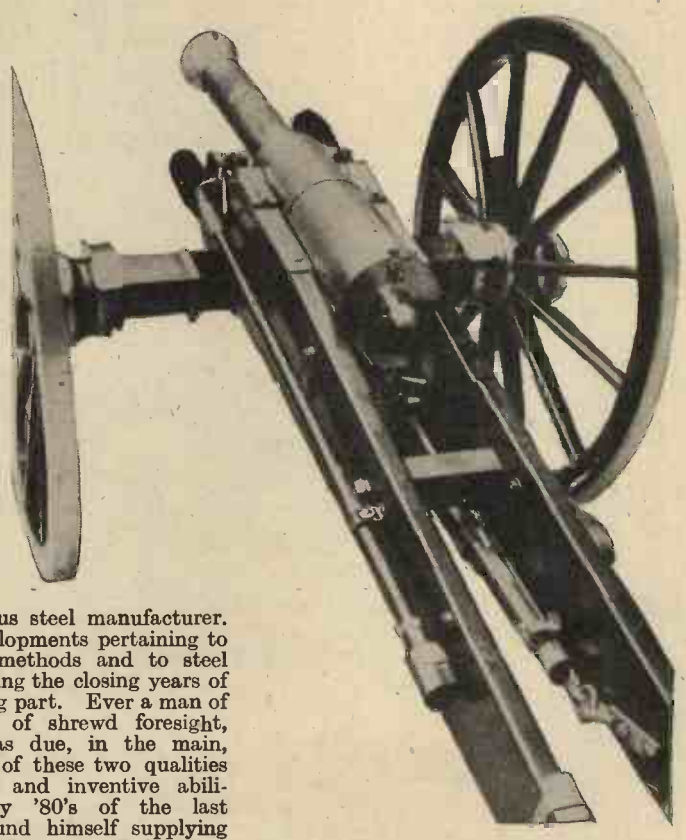
Alfred Krupp died in the maturity of his powers and at the height of his fame on July 14th, 1887. Essen, the town of his birth and the scene of his early endeavours and spectacular achievements, was, also, the place of his death. But whereas more than half a century previously old Friedrich Krupp, the founder of the firm, had died in poverty and in complete obscurity, the death of his famous son, Alfred, resulted in some 60,000 people being present at the latter's funeral.

"Big Bertha"

It was towards the end of the Great War of 1914–18 that the firm of Krupp achieved the most spectacular feat in all its long history—the production of "Big Bertha," the long-range gun which shelled Paris at a distance of more than eighty miles. "Die dicke Berta," as this massive piece of ordnance was termed, was so-named after Fraulein Berta Krupp, a grand daughter of Alfred Krupp, who had an active and controlling interest in the firm.

"Die dicke Berta" certainly astonished the world, but its feats were more extravagant than effectual, although, from a steel-making and engineering viewpoint, its creation constituted a remarkable piece of work.

Nowadays, as a peace-time concern, the Krupp organisation at Essen manufactures agricultural implements, railway steels, pressed steel goods of every description besides countless other steel utilities. It employs upwards of seventy thousand individuals and owns various mills, mines, wharves and other industrial properties. Could, for even a single hour, old Friedrich Krupp, the disappointed and despairing founder of the firm or even his eminently successful son, Alfred, return from the Shades to view the present magnitude of their steel-making organisation their astonishment would surely be great, for, of all the world's gigantic undertakings, that celebrated German industrial firm ranks among the largest.

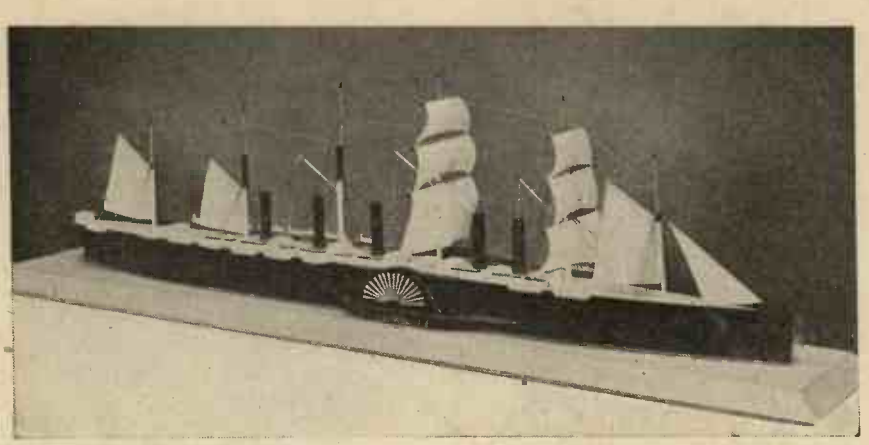


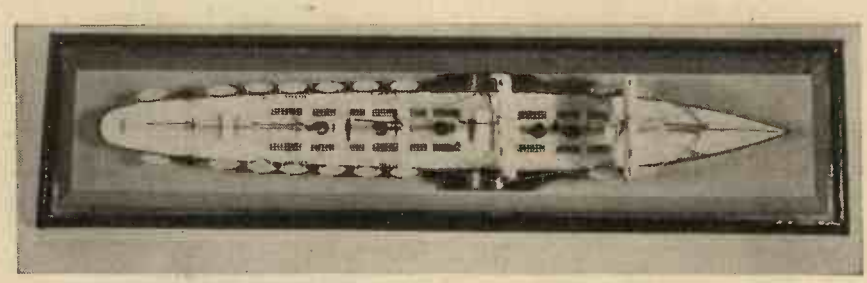
This illustration is from an actual photograph of Krupp's second cannon which he exhibited at the London Exhibition of 1851. It is a 6-pounder cannon and, although muzzle loading, is made of steel throughout.

A MODEL OF BRUNEL'S FAMOUS "GREAT EASTERN"

By W. J. Bassett-Lowke, M.I.Loco.E.

How Screw, Sail and Paddle Were Used to Achieve Speed





(Top): The finished model "Great Eastern," 50 ft. to the inch mounted on a wood plinth. (Below): An aerial view showing the deck plan of the model.

AROUND every ship there lives a story. It may be of the fascinating past, the interesting present, or the mysterious future.

I have before me as I write the image of a little ship, whose story can almost be said to do the impossible—and combine all three passages of time. She has the sails of the past, the funnels of the present, and in her huge size and design Brunel, her famous builder, envisaged the future of great passenger-carrying liners, of which the *Queen Mary* and the blue riband holder *Normandie* at the supreme outcome.

The Delayed Launch

Her name? The famous *Great Eastern*. Built by Brunel, with the idea of carrying large numbers of passengers and cargoes to Calcutta, Australia, and the Far East, she was designed with immense bunker capacity to obviate coaling on these long runs. Her delayed launch unfortunately proved to be more costly than expected and she was sold to the Great Ship Company, making her maiden voyage from Southampton on June 17th, 1860.

She was set to run the North Atlantic, a service for which she was considered unsuitable, but she made the passage in eleven days and thirteen hours. At a later date she laid the Atlantic Cable—a tangible link between the Old World and the New.

This 15-inch model gives me a clear vision of how screw, sail, and paddle were used to achieve speed. The flat black hull with its red line, the red paddle wheels in their smart black and white boxes, the five long thin funnels and neat rigging with a few white sails to add light and variety—all seem to blazon forth the fact that she was an experiment—a sign of changing times—and for these very reasons she is an excellent ship for the model maker to build.

A Kit of Parts

A special set with every part included is available from Messrs. Bassett-Lowke, Ltd. Our illustration show this set which contains the various tools and the necessary paint. You will find construction much easier if you provide yourself with a pair of dividers, a sharp safety-razor blade, and a small drill, which can be made by taking a long pin driving half its length into a penholder or any piece of wood convenient to hold. When fixed file to a fine point.

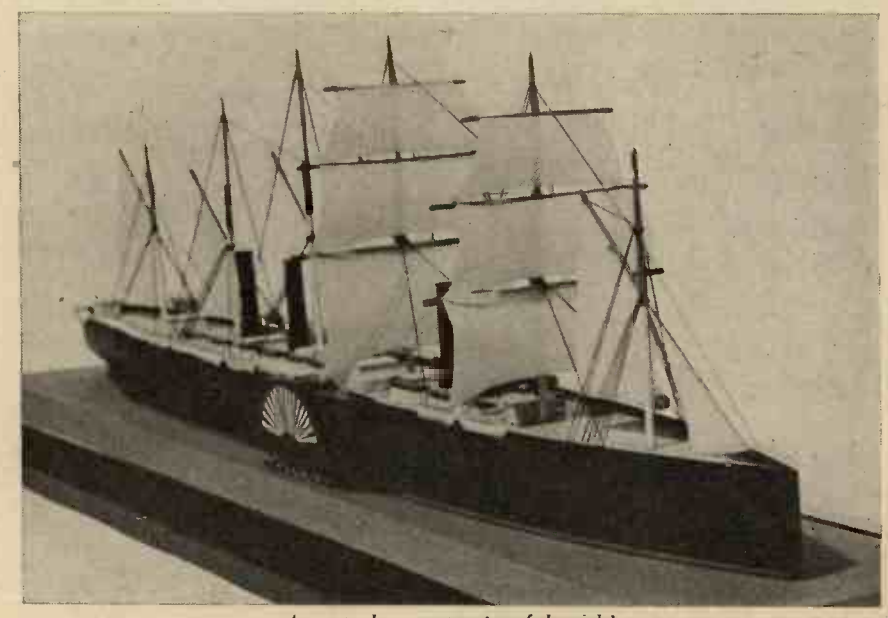
Now for the assembling of the model. No carving is necessary on the hull, so the work of building can straightway be started. Spread adhesive evenly on the deck of the hull and stick the planking firmly in position. Make quite sure this decking lies flat, otherwise the deck-houses will not fit down properly. Trim off the overhang of this decking with a sharp razor blade, and then smooth down the hull with sandpaper. When the hull has a smooth and paintable surface the rudder (found in the small envelope) may be stuck firmly in position with a little adhesive.

The Raised Decks

The three raised decks are fitted with deckings in the same manner as the hull. The deck houses can be recognised from the drawing and are found in the envelope. These have Bristol-board tops to be glued on, and the houses can then be mounted on pins ready for painting.

Next come the paddle boxes. Take their positions from the drawings and mark the hull. First glue on the large half-circle, and before this is quite dry fit the two small parts on either side of the circle, pressing them well together and making sure they are exactly square. The sponsons are stuck firmly under the paddle boxes as shown in the drawing.

Laying the hull aside, you can now paint the deck-houses. The three raised ones are white round the edges and the deck-houses are entirely white, leaving only the bottoms unpainted.



An acute three-quarter view of the model.

Skylights

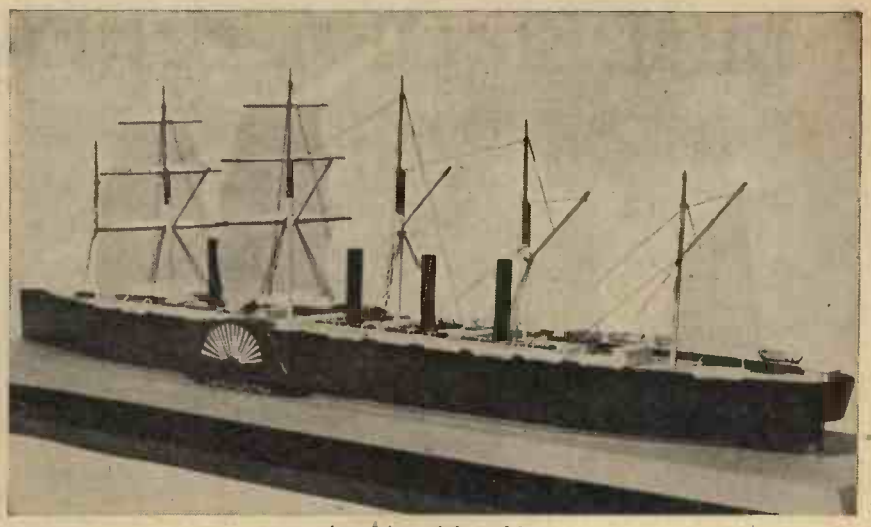
The skylights will be found mounted and only need the window frames to be drawn in black, or, by adding red paint to a little black paint, you will be able to produce the effect of a mahogany finish. Colour the edges of the skylights and draw lines to represent frames.

Returning to the hull, the bulwarks, two long strips of Bristol-board are attached carefully to the edge of the hull. Then the deck fittings. First the raised decks, taking their positions carefully from the drawings. Then the skylights of varying sizes. Stick all firmly in their respective positions with adhesive.

The Funnels

The funnels have a slight rake which is made by sand-papering the bottoms to a very slight angle. The funnel bases (in the envelope) need sticking together before the funnels are mounted. The small Bristol-board punching is stuck on to the thin wooden one. This completed, mount the funnels on these bases. Then give them a coat of black paint, and when thoroughly dry mount in position on the hull. The steampipes fore and aft of the funnels are fitted in small holes drilled beforehand and secured with adhesive.

Careful attention to the drawing will help you to fit the masts, getting the slight rake and correct height. Then with the rigging it is advisable to drill the holes

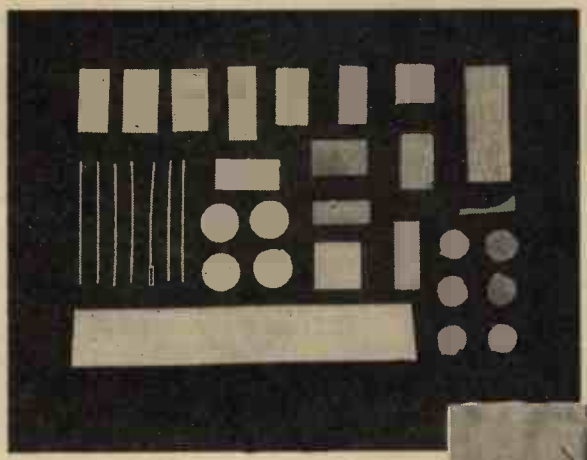


A stern view of the model.

davit should pass into the model. Bend the davit at the correct length from the top at right angles so that, by fitting the davits into the holes made in the side of the hull, the boats will hang as shown in the drawing. All these lifeboats should be the same height and run in line.

The sails are marked out on sail cloth and should be cut out and fixed (one at a time) with a little adhesive to the yards.

A finishing touch can be added by cutting up the small piece of blue paper in the envelope to produce the effect of splash openings in the paddle box.



The small set of parts contained in the envelope in the top left-hand corner of set of parts shown on the right.

before painting the hull. This done, paint the hull and paddle boxes black. Then make and fit the paddle wheels, which are provided in Bristol-board, cutting out with a sharp knife. This is a delicate job and needs firmly sticking, before the model is screwed down on its blue base.

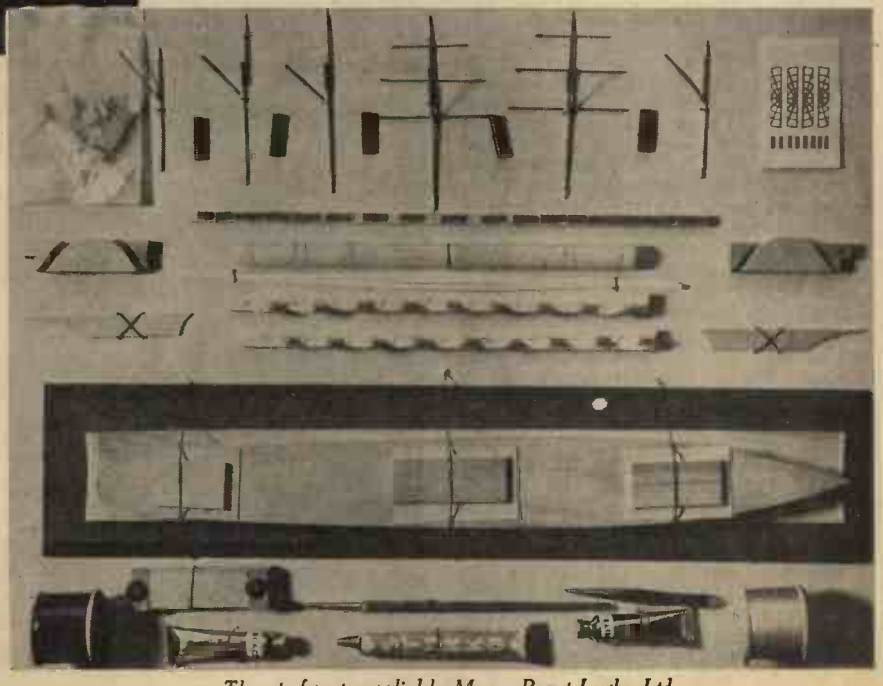
The Rigging

Now for the rigging, which commences with the foremast, in black rigging silk then the lower shrouds of all the masts, then the back stays, then two lower forestays. The topmast forestays and single ropes can be easily followed on the plan, and run down the ship from mast to mast, fixing the foremast stays in the bows.

Then comes the running rigging, lifts, and braces in cream silk, and a careful study of the plan will help you. Make fast the ends with a little adhesive.

Lifeboats, etc.

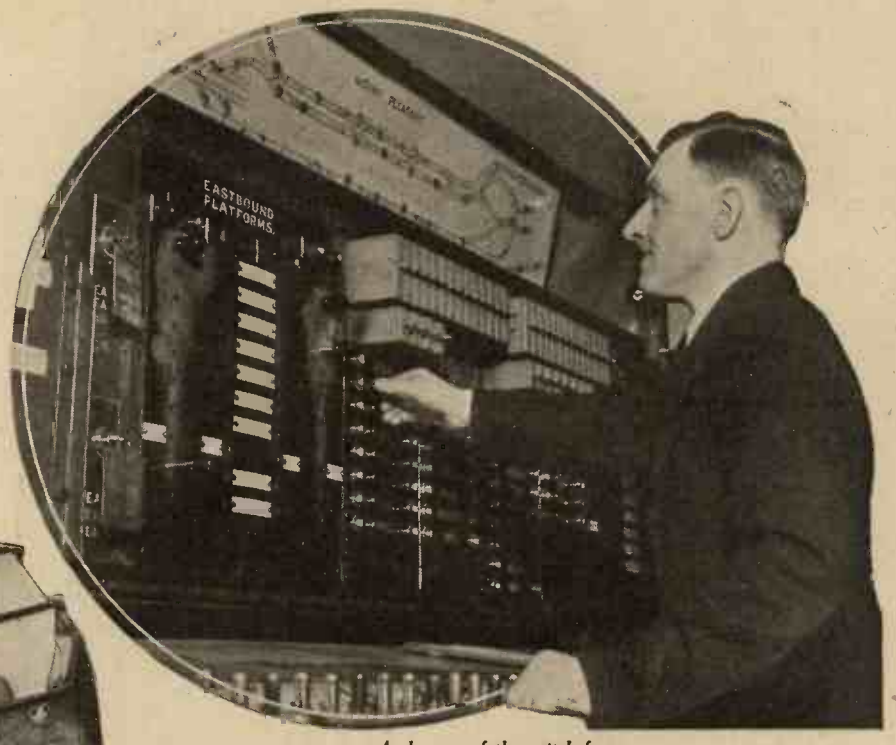
You now have to fit the lifeboats, drilling holes in the sides of the hull where each



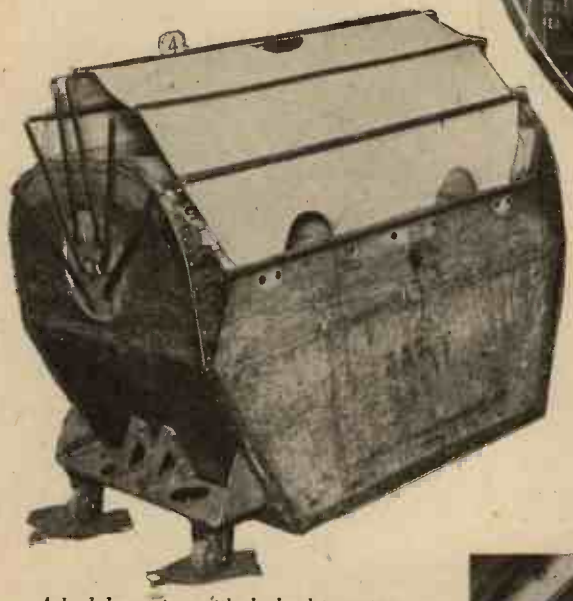
The set of parts supplied by Messrs. Basset-Lowke, Ltd.

AN UNDERGROUND MAIL TRAIN

This Descriptive Article by Major W. G. Carter, M.C. (Assistant Controller, London Postal Region) which, with Illustrations, is Reproduced by Courtesy of the Post Office, Describes How the Delivery of Mail is Speeded up.



A close-up of the switch frame.



A loaded container with the hood in position.

SOME years before the war, when road traffic conditions in London were not nearly so congested as at the present time, the smooth transport of mails was so much hampered as to make it desirable to explore the possibility of providing other means of conveyance between the principal post offices and railway stations in London, whereby delay, caused by street congestion, fogs, etc., could be avoided. In 1909 a Departmental Committee was set up to consider the question, and they at last decided that the best solution to the problem was to construct an underground tube railway. The unique feature of the proposal was that the trains should be automatically controlled and should run without drivers.

A number of years elapsed, and it was not until 1928 that the railway first commenced to operate. By that time, however, the old horse-drawn vehicles had been very largely replaced by motor-vans, but street congestion was daily becoming worse. With the use of motor-vans, and the increasing experience of drivers in selecting the quickest, although not necessarily the most direct route between offices, it is doubtful if any appreciable time benefit is obtainable for short journeys between stations on the railway, as the bags have to be transported below and above ground, and are subjected to various handlings. A considerable benefit is, however, obtainable on the longer journeys, as the average speed between stations is 25 miles per hour. Such advantages are, of course, greatly increased during times of fog, or heavy congestion on the streets.

Eight Stations

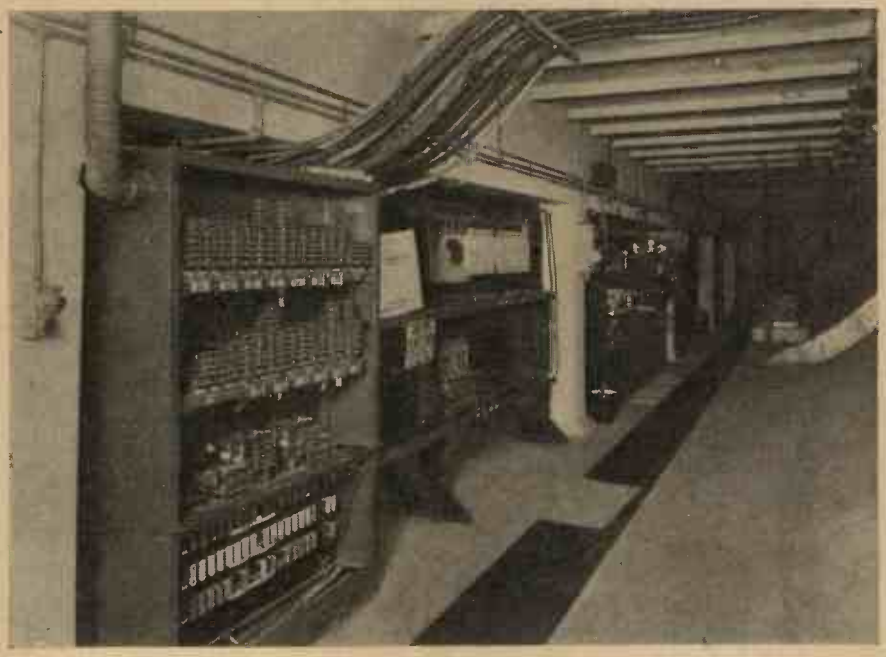
In brief the railway consists of a steel-lined circular tunnel constructed at a depth of about 70 ft. below the streets of London. It is level for the greater part of the route, but deviations exist where it has had to be taken either above or below the passenger

Showing a train passing along one of the many tunnels.

railway tubes, main sewers, etc.

It is fitted with two running tracks over which electric trains, without drivers, run automatically in each direction. The length of the railway is six and a half miles, and there are eight stations situated along its length, each of which is connected with a post office building, or a main line railway station. The greatest distance between any two stations is 1 mile 293 yards, and the smallest 380 yards.

Each station is raised above the level of the main line running track, so that arriving trains are decelerated, and those departing accelerated. A station actually consists of two larger parallel tunnels constructed on the same horizontal plane, and joined together by cross passages. One tunnel takes the westbound traffic, and the other the eastbound. The stations vary in length, the longest being 313 ft. and the shortest 90 ft.



The relay cabinet.

In addition to the electrical equipment required for running the trains, each station is provided with ample auxiliary plant for conveying mail bags from and to the offices situated above.

For convenience in maintenance and costing in dealing with failures, the equipment of the railway has been divided into five sections, namely, Permanent Way, Generating Plant, Control Apparatus, Rolling Stock, and Auxiliary Plant.

Permanent Way

The main line running tunnel is circular in shape and has an internal diameter of 9 ft. It is built up of flanged steel segments, 20 in. in width, bolted together. Near stations this tunnel is branched out into two single-track tunnels of 7 ft. diameter, and these join up to the two station tunnels, which are 21 ft. 2½ in. or 25 ft. in diameter. Loop tunnels and sidings tunnels, are also provided. The bottom of the main line tunnel is filled with loose ballast covered over with a concrete raft 12 in. thick. Inverts are formed in this for each running track, and oak sleepers to carry the rail are let transversely into the concrete at intervals of 4 ft. 3 in. The running rails are secured to these sleepers by means of ¾-in. coach screws, and the insulators which carry the conductor rail are also mounted on the sleepers.

The running track consists of a pair of flat-bottomed rails, each weighing 35 lb. per yard, fixed to give a gauge clearance of 2 ft. on the straight. One of these rails is made electrically continuous, and is bonded to the tunnel and also to a bare copper conductor in order to provide a return path for the current used to propel the train. The other rail is insulated, and divided into sections for the purpose of track-circuiting.

The Conductor Rail

The conductor rail consists of channel sectioned mild steel, weighing 15 lb. per yard, and is mounted on insulators so that it lies centrally between, but 3 in. above, the pair of running rails. The rail is also divided into sections insulated from each other.

Opposite each station platform two running tracks are provided, one for non-stopping trains, and the other for bringing stopping trains alongside the platform. The latter track is divided along its length to provide the number of train berths which the station is designed to accommodate. The number of berths at each station varies from one to three on each platform. On each track, in station areas, electrically-operated points are fitted for diverting the trains from one track to another, or into sidings or loops.

At the top of each main line tunnel, sufficient lights are fitted to give safe walking conditions, and a pair of bare wires are provided to which portable telephones can be connected to establish communication with the station staff.

Overcoming Dampness

When the line was first operated, considerable difficulty was experienced due to the very damp conditions prevailing in the tunnels, but water pumps, ventilation, and general heat dissipation have entirely overcome this.

A more serious trouble was brought about by the rapid rate of wear which took place on the sides of the running rails, the track points, and crossings, caused by the grinding action of the car wheels. This increased rapidly until, in 1931, it was found necessary to employ gangs of men practically every Sunday on renewals. During that year 17,000 yards of rail were changed or turned at considerable expense. The position had then become serious, and steps have since been taken to overcome the trouble by using harder rails, by fitting automatic lubrication on sharp curves, and by altering the design of the cars. Very satisfactory results have been obtained, for in 1936 only 3,120 yards of rail were changed, or, in other words the wear effects had been reduced to 18 per cent. of those for 1931. Still better results will be obtainable in future.

Generating Plant

Electrical energy for working the railway is obtained from the Department's bulk supply, which is provided by two outside

(*Continued on page 112*)

Loading containers.

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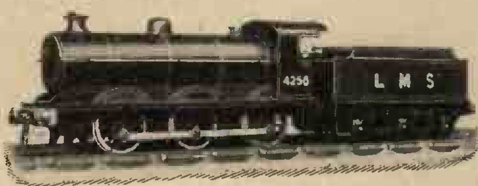

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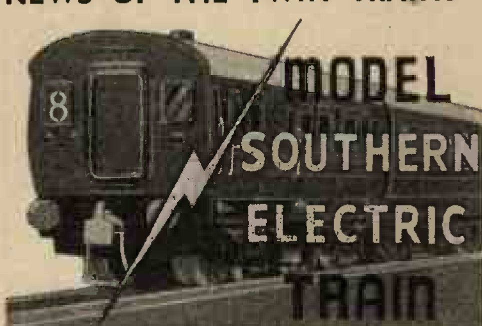

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Actual Photograph of Bond's British Permanent Way.

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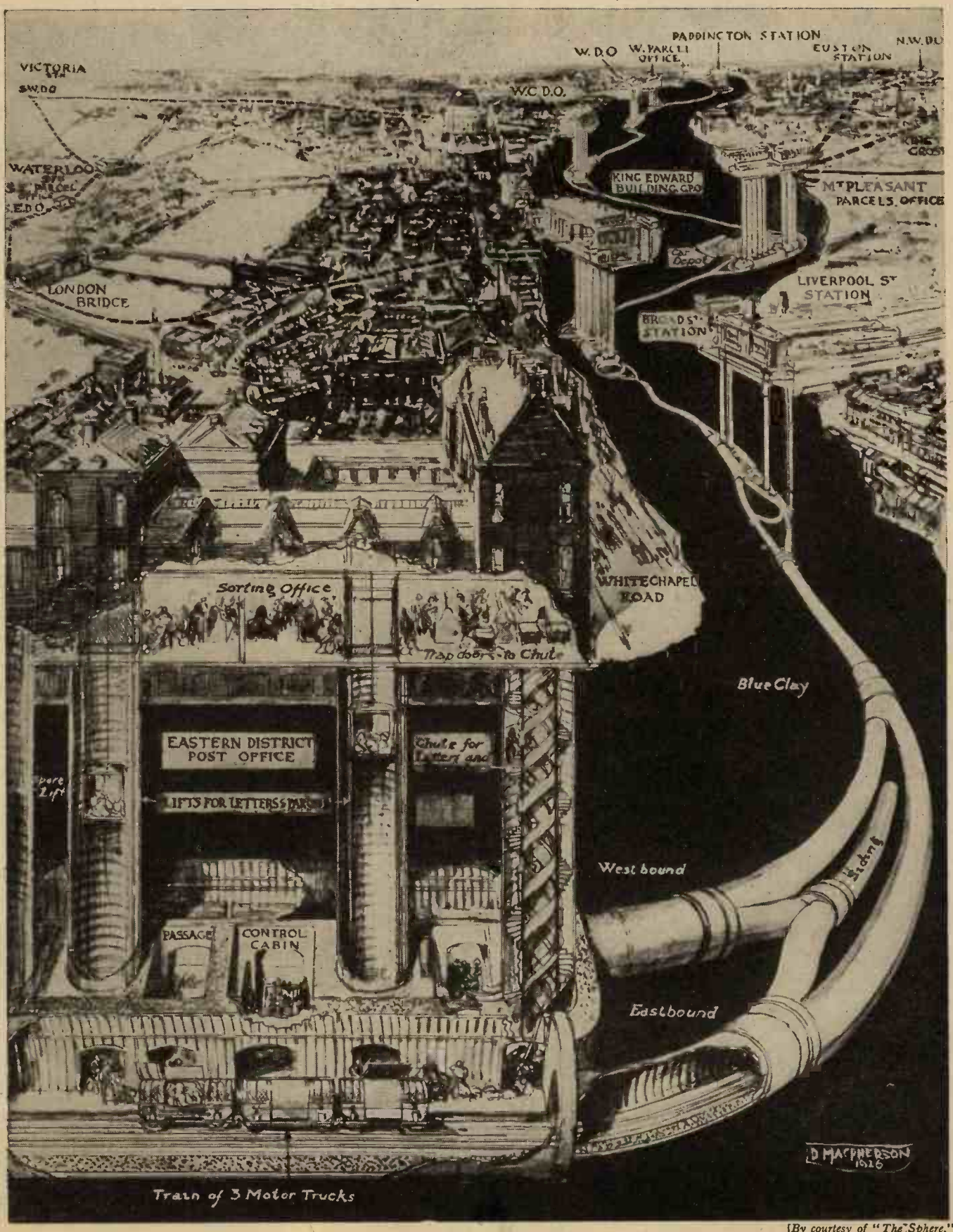
A DIAGRAMMATIC DRAWING OF THE POST OFFICE (LONDON) RAILWAY.



[By courtesy of "The Sphere."

(*Continued from page* 108)

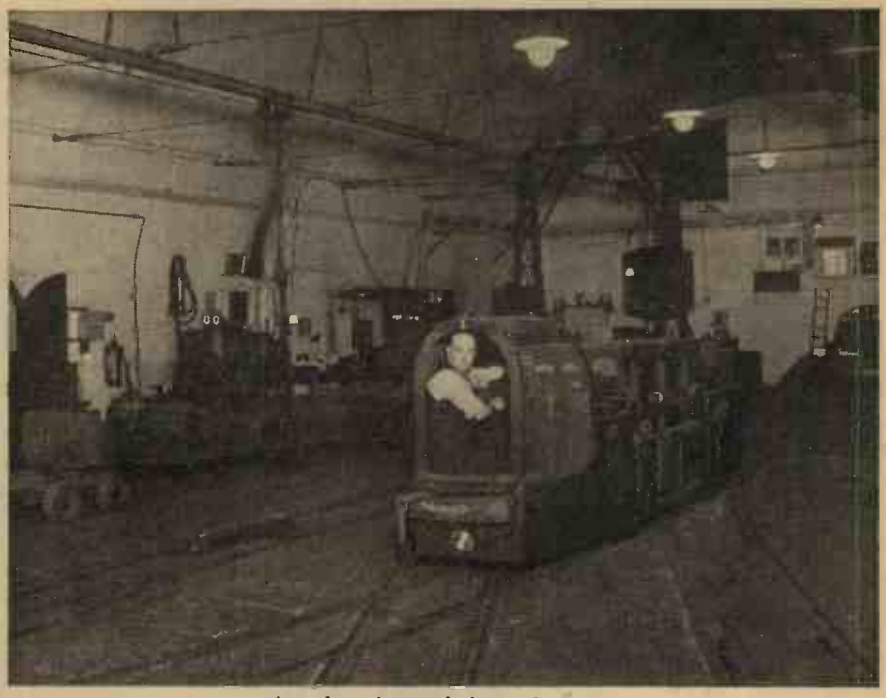
supply companies. Provision is made so that, in the case of a failure on one supply, the whole of the railway load can be switched over to the other.

The energy is brought to three sub-stations on the railway in the form of three-phase high-tension alternating current at 6,600 volts pressure. The voltage is there reduced by static transformers, and then converted to direct current at 440 volts pressure by means of rotary converters. There are two such converters at each sub-station, each of 400 kilowatts output, and the load is such that it can be met by running one machine. This 440 volts direct current is used for driving the trains over the high-speed sections, for starting trains from rest, for the electric lighting of the stations, and for providing the necessary energy for the electric lifts, conveyors, and other auxiliary plant.

Current is also necessary at a lower voltage, and this is obtained by means of motor generators, two of which are fitted at each of the eight stations. They have 20 or 30 kilowatts output at a nominal voltage of 150. This energy is used for the trains when passing over low-speed sections, for operating contractors, and also for the control circuits required for the lifts and other plant. It is also utilised for charging the batteries of secondary cells required for providing current at a steady voltage of 24 for track-circuiting.

Energy Meters

Each station has a main distributing switch-board for dividing up the energy between the various services, and on these switchboards energy meters are fitted so that the consumption can be separately recorded for traction or auxiliary plant purposes.



A car depot showing the battery locomotive.

As some check on efficiency in running, the traction current is compared weekly with the car-miles run, and such records are carefully kept in the form of graphs, and included in the annual returns. It is of interest to note that whereas in 1932 the watt-hours per car-mile figure averaged out to 1,221, that for 1936 was 1,188, representing a saving of approximately 60,000 Board of Trade units per annum.

Up-to-date figures of the annual consumption of electrical energy on the railway are 2,128,125 units for traction, 991,750 for auxiliary plant, and 113,239 for car-shed, making a total of 3,233,114 units.

In order to provide sufficient illumination in cases of failure, or when the plant is shut down, an emergency lighting supply is taken from the office above each of the stations to a requisite number of fittings.

NEW INVENTIONS

Foot Ventilator

AN air-cooled shoe has just made its advent. This shoe has a heel hollowed out to provide an air reservoir. The air is admitted at the side of the heel. There is an inlet tube connecting with one of the eyelets and extending along the side of the shoe. Aerated footwear should add to the comfort of the hiker, who can now literally walk on air.

Can Drinking Spout

SOME time ago I commented upon a spout which could be fixed upon the edge of a saucepan. Akin to this is a lately patented invention which is styled a can drinking spout. The new device is made of flexible sheet material provided with a margin for gumming to the outside of a tin. It is formed to embrace the side wall as well as the end of the tin. Judging by its title, the spout has been devised with the idea of the direct application to it of the human mouth, which would dispense with a cup. The philosopher, Diogenes, would certainly commend this feature, as he was a past master in the Art of Doing Without.

Money and Meat Safe

FOLLOWING closely upon the heels of a recently devised combined refrigerator and wireless set comes a refrigerator with which is incorporated a safe deposit. This consists of a relatively small and practically burglar-proof box which occupies a position in the internal economy of the refrigerator. To place one's valuables in the neighbourhood of the Sunday joint is the next best thing to entrusting them to the care of a joint stock bank.

Paper Savings Bank

AN American has thought fit to patent a paper savings bank. His invention is in effect an envelope with a slot for the admission of coins. Such an envelope could be sealed in a manner which would prevent an unauthorised person opening it without detection. It may be useful to those good folk who in the reign of Queen Victoria were incited to thrift by a story entitled, "How Paul's Penny became a Pound."

Maturing With Music

THERE has recently been patented in the United States a method of ageing liquor which comprises applying sound waves directly to a continuous volume of liquor. I am not an authority upon the art of rendering drinks venerable, but I feel moved to express the opinion that, for the purpose of maturing the vintage by means of sound, some tunes would be eminently appropriate. For instance, "Simon the Cellarer" automatically crops up in the mind. One concludes that that melody would be more acceptable to the brewer than "Drink to me only with thine Eyes."

Holdfast for Cigarettes

SMOKERS who use a cigarette holder will be interested in a gadget which is designed to prevent the cigarette from escaping from the holder. The new holder has in its side an opening through which a kind of fluke secures the cigarette, but not so firmly that it cannot be released. Verily a cigarette holder!

Head Buffer

AN improved safety hat now rivals the metal helmet which was a familiar object during the Great War. This new headgear has a crown consisting of rigid, blow-resisting material. In the inside of the cap there is cushioning means to enable it to fit comfortably to the sides and back of the head. In the event of a cascade of falling bodies, this invention will reinforce the armour of the cranium with which Nature has already protected the brain of mankind.

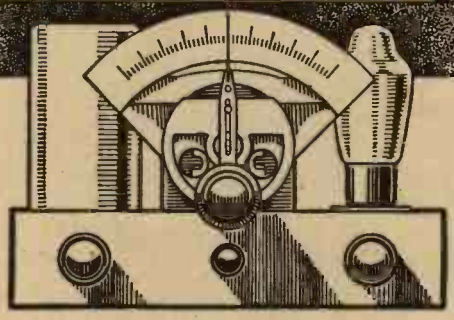
For the Order of the Bath

WHEN the plug of a lavatory basin or bath is temporarily removed from the hole through which the water makes its exit, it is usually placed on a shelf or ledge, or its chain is looped over the tap. In the last-mentioned case, there is a danger of it becoming entangled, as sometimes happens to the chain which prevents pince-nez from absconding. To remedy the haphazard disposal of the plug when it is not on duty, an inventor has devised a basin with a hook on which the plug can conveniently be suspended. This is a simple device, but it will contribute to the amenities of the bathroom.

DYNAMO.

The PRACTICAL MECHANICS

WIRELESS EXPERIMENTER



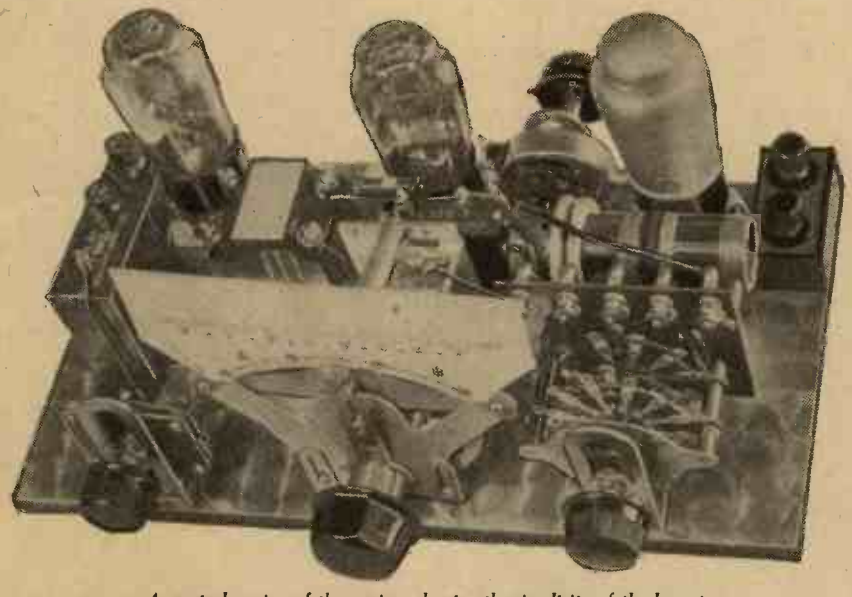
A SIMPLE ALL-WAVE THREE

A Simple All-wave Three-valve Battery-operated Receiver—Circuit Description and Constructional Details.

THIS receiver has been specially designed for beginners. A baseboard has been used in preference to a chassis, as this simplifies the wiring diagram and the wiring without materially affecting the efficiency of the finished instrument. In order to ensure effective earth-line connection for short-wave reception, however, a metal-covered type has been chosen.

Circuit Arrangement

Although the receiver is primarily intended for beginners it must not be imagined that efficiency has been sacrificed to provide a simple design. The set employs a well-tried straight-three circuit arrangement, and the specified components are all of a reliable type. The all-wave coil used is sturdily constructed and all the internal wiring is completed by the manufacturers; it is only necessary for the constructor to attach the necessary external leads to the terminal board. The switch attached to the coil unit has four positions—short-wave band, medium-wave band, long-wave band, and off. In the off position the L.T. — lead from the accumulator is disconnected from the valve filaments so that no current will be consumed from the L.T. accumulator or from the H.T. battery. A ·0005 mfd. condenser is used for tuning, and with this capacity in use the wave-bands covered will be approximately 19 to 48 metres, 200 to 550 metres, and 900 to 2,100 metres. The tuned circuit is fed to a triode detector of the metallised type, and reaction is obtained by connecting the anode of this valve to the reaction winding of the coil unit.



A semi-plan view of the receiver showing the simplicity of the layout.

L.F. Amplifier

The coupling between the detector and the first L.F. valve is of the resistance-capacity type, the grid leak of the L.F. valve taking the form of a variable potentiometer. This control will be found very useful, especially when listening on the short-wave band. By reducing its setting, headphones can comfortably be used in place of a loud-speaker when desired. It will be noted that an H.F. choke has not been used in the anode circuit of the detector valve. It was found that a resistance of high value connected in the grid circuit of the first L.F. valve served the same purpose—this is the 100,000 ohm resistance R4.

The detector anode circuit is effectively decoupled by means of the 10,000 ohms resistance R3, and the 1 mfd. condenser C5.

Coupling between the L.F. valve and the output triode is effected by means of an L.F. transformer having a ratio of 3·5 to 1. This ensures adequate amplification in this stage without producing instability. A pentode could have been used in the output stage but better quality is generally obtained in a straight three of this type with a power triode in this position. It will be noticed that a 2-mfd. condenser is connected between the H.T. + 3 lead and the metal covering of the baseboard. This component is not essential if a new H.T. battery is used, but will prove very helpful in keeping the receiver stable when the battery is running down.

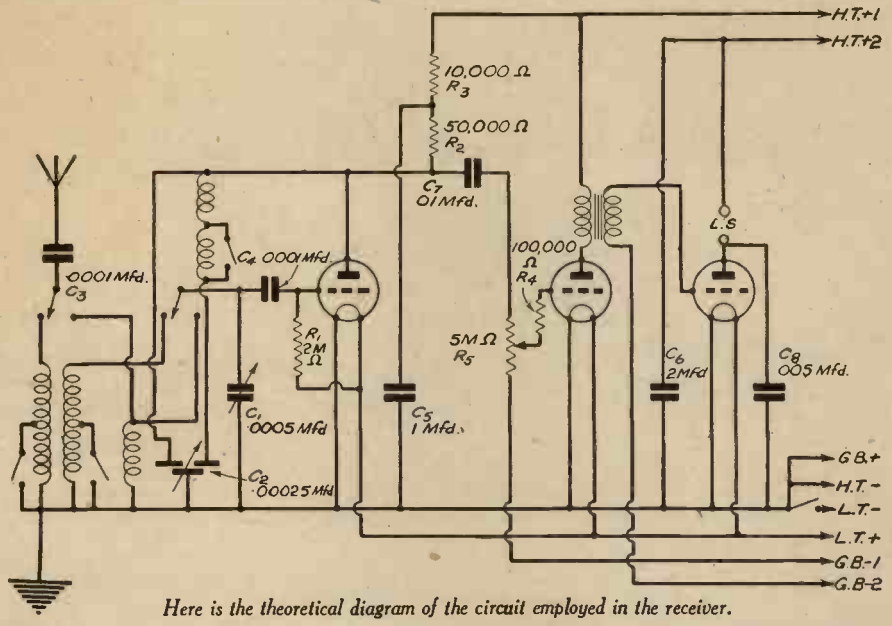
Constructional Work

The position of all the components and wiring is clearly shown on the wiring diagram, and no difficulty whatever should be experienced with the constructional work. There are a few points which need emphasising to beginners, however. A block of wood will be supplied with the baseboard which should be used to raise the tuning condenser spindle to the level of the tuning drive. It will be advisable to remove the left-hand front leg of the tuning condenser to ensure exact mounting of the drive, and the other three legs should then be securely screwed to the wooden block. It is essential, however, that the frame of the condenser be in contact with the metal covering of the baseboard and therefore a lead must be taken from one of the back legs to M.C., as shown on the wiring diagram—M.C. is, of course, the abbreviation normally used for the metal covering of the baseboard.

Another precaution which should be taken is in connection with the coil unit; this must be mounted sufficiently high on the component bracket to ensure that the switch tags are well clear of the baseboard. The bracket itself must, however, make good contact with M.C. as the earth return leads of the coil are connected to the switch frame, and if good connection is not made between the bracket and M.C. the earth end of the coil windings will not be in contact

LIST OF COMPONENTS

One all-wave coil, type G (B. T. S.).
One tuning condenser, ·0005 mfd., type C.V.1 (C1) (Bulgin).
One tuning drive, No. 2,134 (J. B.).
One reaction condenser, ·00025 mfd. (C2) (B. T. S.).
One volume control: 500,000 ohms (R5) (Erie).
Four fixed resistances: 2 meg. (R1); 100,000 ohms (R4); 50,000 ohms (R2); 10,000 ohms (R3)—½ watt (Erie).
Six fixed condensers: 2 mfd. (C6); 1 mfd. (C5), (type 65); ·01 mfd. (C7); ·005 mfd. (C8); two ·0001 mfd. (C3, C4) (tubular) (T. C. C.).
One L.F. transformer—Nicket 3·5/1 (Varley).
Two terminal brackets with L.S. and A.E. terminals (Belling-Lee).
One fuse holder with 60 mA fuse (Microfuse).
Three valveholders, 4-pin, baseboard type (B. T. S.).
Six wander plugs: H.T.1, H.T.2, H.T. —, G.B. +, G.B. — 1, G.B. — 2 (Clix).
Two spades: L.T. —, L.T. + (Clix).
Three component brackets (Peto-Scott).
One Plymax baseboard (11 in. by 6 in.) with condenser block (Petro-Scott).
Three valves: D.210, L.210, P.215 (Hivac).
One speaker—Stentorian Junior (W. B.).
One pair headphones (Ericsson).
120 v. H.T. battery, 9 v. G.B. battery, 2 v. L.T. accumulator (Exide).



Here is the theoretical diagram of the circuit employed in the receiver.

with the tuning condenser and valve filaments.

Wiring

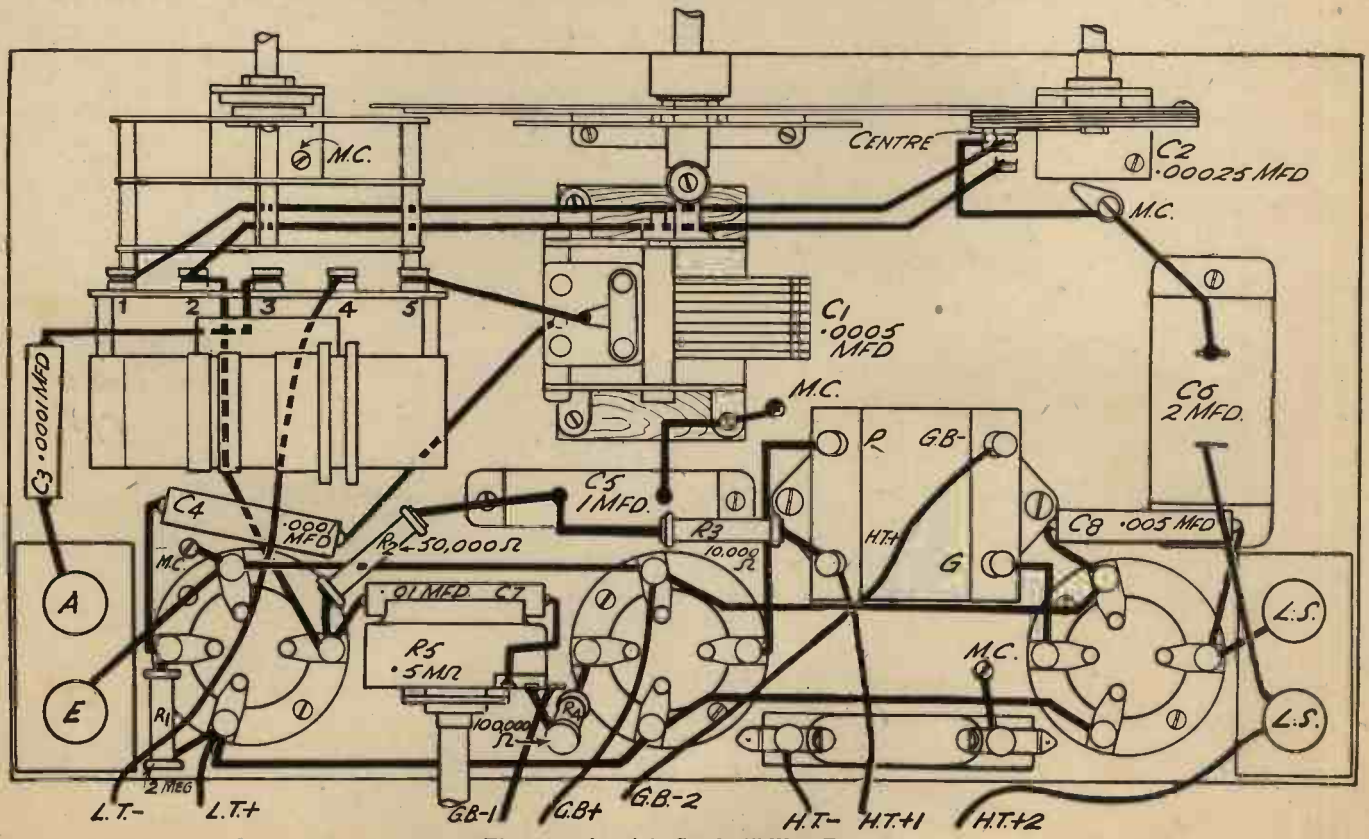
If you have not wired a receiver before you will probably find that it is a little difficult to get the wires into the various odd corners of a compact receiver of this type and therefore a good plan is to mount the parts a few at a time, and wire up as you go. Thus, screw down the three valve-holders and connect the wires as shown in the wiring diagram. You can use bare tinned copper wire (say 18 or 20 gauge), or the standard insulated wire sold for the purpose. In this case you must, of course, scrape away the insulation from the end of the wire where it makes contact with the terminals. Use a fairly blunt knife for this, or you may cut into the soft copper wire and eventually a fault will develop due to the wire breaking where it was partly cut through. When the valveholders are wired, mount the rear control and connect this up. Next screw down the two fixed condensers and the L.F. transformer and wire up all that you can to them, following again the wiring diagram. A good plan where wiring is done in stages in this way is to score through the wire on the wiring diagram as you place it in position. Use a blue or red pencil so that no mistake can arise and you will then be sure of putting in every wire and not trying to put a wire in the wrong place. Finally, mount the coil unit and condenser and complete the wiring.

Battery Connections

After the wiring has been carefully examined the battery leads should be connected up. The L.T. — and L.T. + leads should, of course, be joined to the — and + terminals of the 2-volt accumulator, the G.B. + lead to the + socket of the 9-volt G.B. battery and the H.T. — lead to the — socket of the H.T. battery. G.B. — 1 is the bias lead for the L210 valve and should be inserted into the — 3 socket of the G.B. battery. The P215 valve requires a bias of 9 volts for an anode voltage of 120 volts and therefore G.B. — 2 lead must be plugged into the — 9 socket of the G.B. battery. The voltage required for H.T. + 1 is somewhat critical, and the correct socket can best be found by experiment. In the laboratory model, best results were obtained with this plug inserted in the 108-volt socket. H.T. + 2 requires the full voltage of the battery and should therefore be inserted in the 120-volt socket.

The aerial and earth leads may now be connected to the terminals marked A and E and the loudspeaker leads to the L.S. terminals. The position of the valves is, of course, important, and therefore care should be taken to insert these into the correct sockets in the first place ; the D210 should be placed in the holder nearest the terminals marked A and E, the L210 into the centre holder, and the P215 into the holder next to the L.S. terminals. The receiver is now ready for switching on.

Preliminary tests should be carried out on the medium-band. Note that when the reaction control is advanced, a slight re-adjustment of the tuning dial will be called for. When tuning on the short waves you will find that the receiver should be kept in its most sensitive condition, by adjusting the reaction condenser just short of the oscillating point. You will be able to distinguish this setting by a rushing noise in the loudspeaker.



The wiring plan of the Simple All-Wave Three.

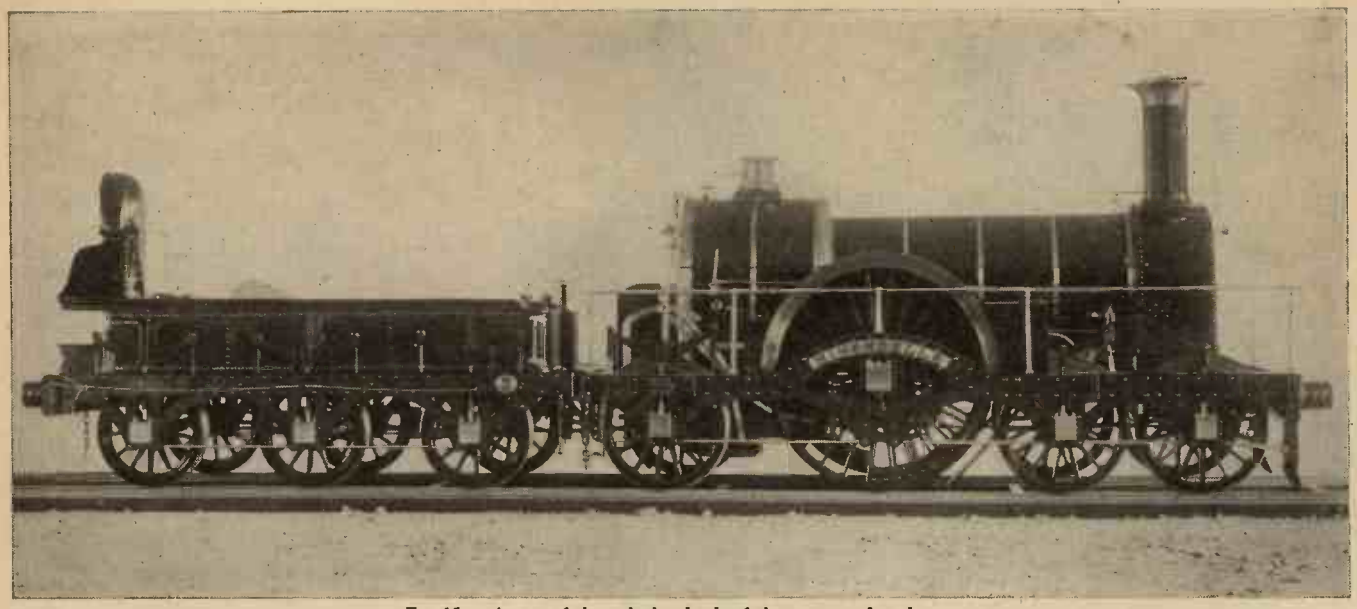


Fig. 15.—A view of the right-hand side of the engine and tender.

A Model G.W.R. Broad Gauge Locomotive—Part V.

By E. W. Twining

OWING to unavoidable happenings and pressure of other work I have been unable, up to the present, to continue this series and I apologise, particularly to those readers whom I happen to know have been awaiting further details. Of these details nearly all that are necessary for the building of the locomotive have been given.

Boiler Fittings

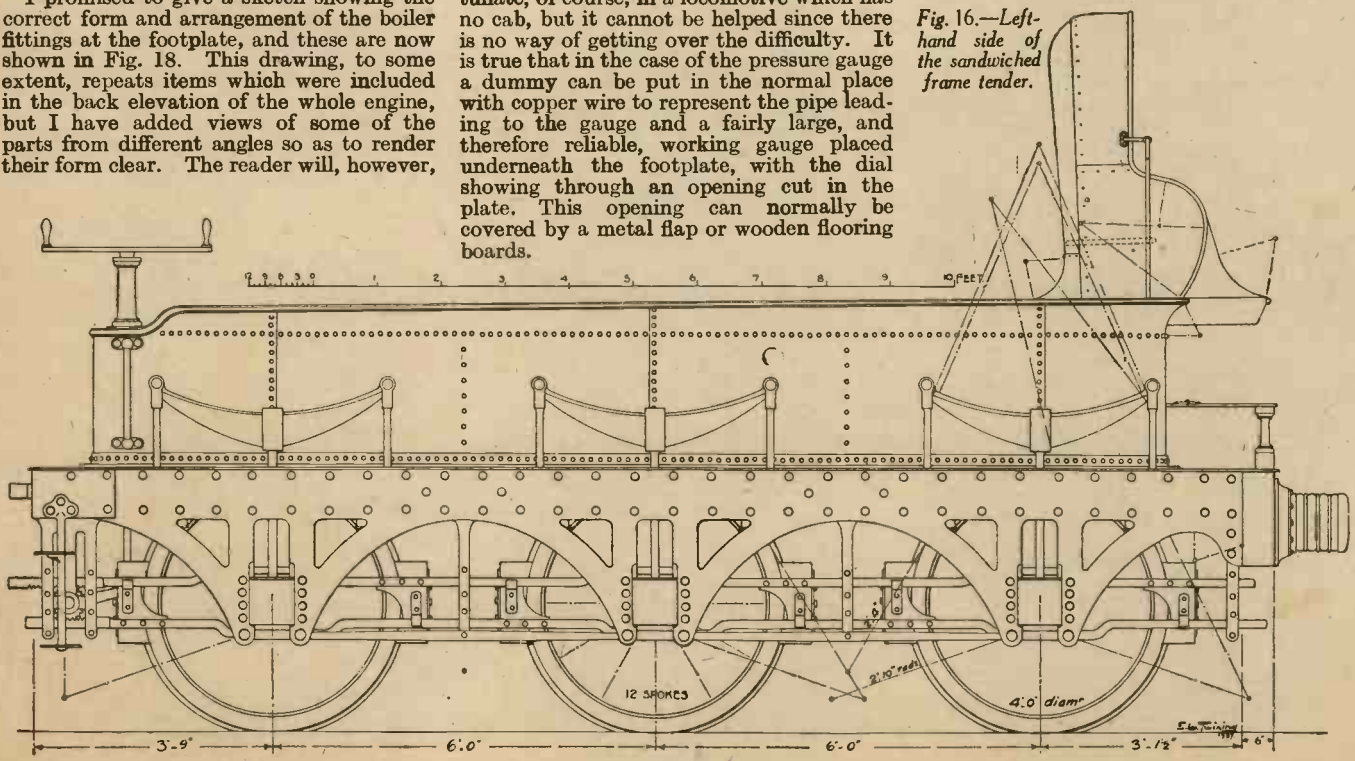
I promised to give a sketch showing the correct form and arrangement of the boiler fittings at the footplate, and these are now shown in Fig. 18. This drawing, to some extent, repeats items which were included in the back elevation of the whole engine, but I have added views of some of the parts from different angles so as to render their form clear. The reader will, however, realise that such things as the stream pressure gauge and the water gauge can only be made, as shown, in dummy form for an absolute scale model.

For a working model the water gauge will have to be much larger and the pressure gauge not only larger in diameter, but deeper from back to front. This is unfortunate, of course, in a locomotive which has no cab, but it cannot be helped since there is no way of getting over the difficulty. It is true that in the case of the pressure gauge a dummy can be put in the normal place with copper wire to represent the pipe leading to the gauge and a fairly large, and therefore reliable, working gauge placed underneath the footplate, with the dial showing through an opening cut in the plate. This opening can normally be covered by a metal flap or wooden flooring boards.

The whistles will in any case have to be dummies and, if it is desired, a working whistle, which is large enough to give a musical note, can also be put underneath the footplate.

In all probability the safety valve spring balance, which is shown in Fig. 15, will be dummy, but this will depend upon the model-maker's skill and ability to make a spring balance to function properly in this small scale. It can be done, in which case

Fig. 16.—Left-hand side of the sandwiched frame tender.



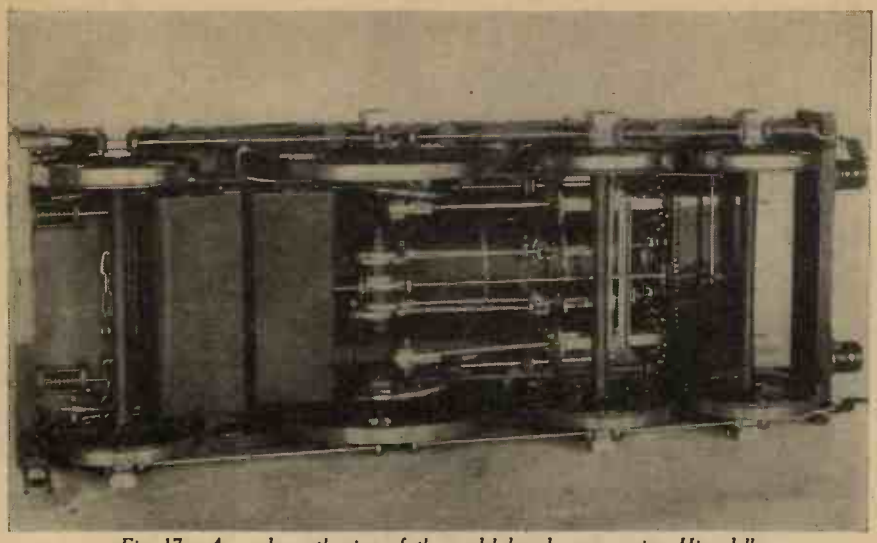


Fig. 17.—An underneath view of the model broad gauge engine, Hirondelle.

there will be two safety valves on the boiler; one direct loaded by a powerful spring and the other loaded through the medium of the long lever. If the springing of the lever is dummy then one safety valve will have to suffice. Both the valves are shown in Fig. 16.

Underneath Details

In my previous articles I have shown reproductions of two or three photographs of my own 1 inch scale model of the "Hirondelle," and here I give in Fig. 17 a view of the underneath side of the engine showing the whole of the motion with the cranked axle and the valve gear, all assembled ready for working. This picture was, in fact, taken after the engine was completely finished off, including the painting.

If the reader compares this photograph with the cross section given in Fig. 13 (June, 1937 issue), he will see that there is a difference in the form of the motion plate. As I showed this plate in the drawing it would run right across the engine and partly hide the valve gear; but, as a matter of fact, in my own engine the motion plate was in two parts, exactly as it was made in the real engines, but my own model was built one-third bigger than the one I have been showing in all the drawings, and I thought that it would be easier and more convenient for the reader to let the motion plate be independent of the boiler and act as a frame stay. The two plates in my engine were actually attached to the boiler, a feature which, in a model as small as ¾ inch to 1 foot, would make the assembling of the motion and valve gear a very difficult matter, because it would all have to be put together after the boiler is in place.

It may be noticed in Fig. 17 that there are some other differences and some things which have not been shown in the drawings given in these pages; such, for instance, as the spring buffers between the engine and tender, and the pumps which are worked off the crossheads. In the ¾ inch scale model, too, I have omitted from the drawings the centre bearing for the cranked axle, another item which is attached to the boiler and which I think may very well be omitted. Of course, if the reader prefers to fit boiler feed pumps driven by the engine he may do so, but it was my intention to show in the concluding article a hand-operated pump in the tender.

Broad Gauge Tenders

As I have previously mentioned some of the 8 ft. singles, the earliest of them, had tenders with frames entirely of iron and of these the "Lord of the Isles" was one. Subsequent to the date of building this particular engine the framing was of double slotted plates with oak sandwich between them. I illustrate this latter type first: it was by far the more numerous. Fig. 16 is a left-hand side elevation showing the complete brake gear. The whole of the six blocks were on the left-hand side only, and there were none on the right. In the sandwich framed tenders the rods which pulled the blocks on to the wheels were fitted at the footplate end with racks with which engaged a pinion on the brake shaft. This pinion was revolved through the medium of a cranked arm on the shaft, the arm being raised by the usual screw operated by the fireman revolving the handles shown above the tank.

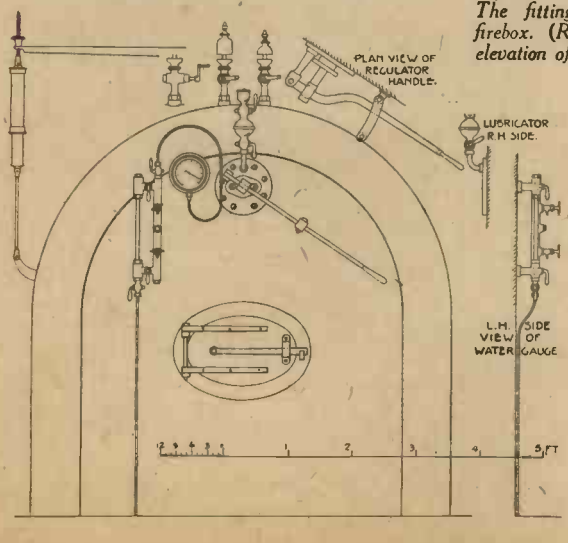
Travelling Carriage Porter's Shelter

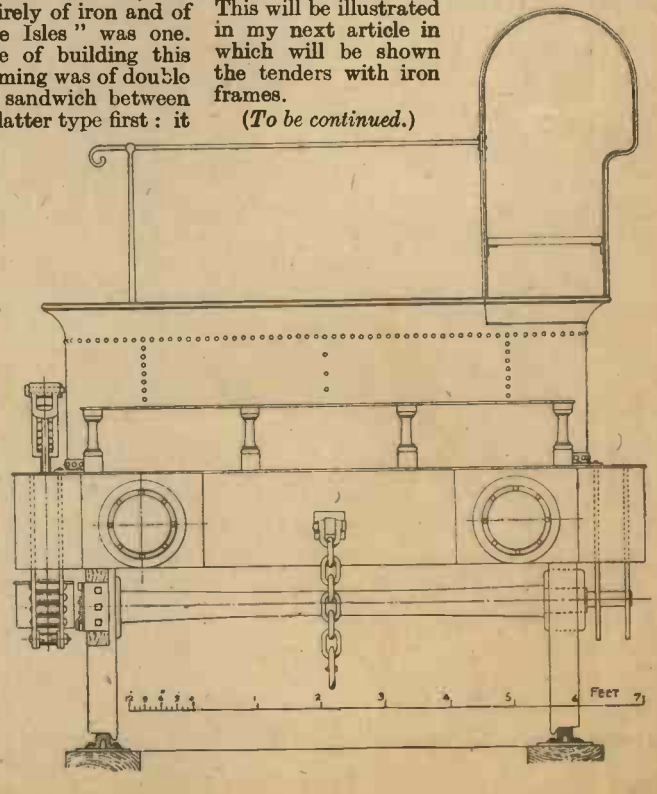
Fig. 15 is a general view of the right-hand side of the "Hirondelle" engine and tender. Little of the brake rigging can be seen in this photograph, but it clearly shows the shelter which was a peculiar feature of the Great Western engines from towards the end of 1847, and which remained in use for several years. This shelter accommodated a man who was known as a "travelling carriage porter," whose duty it was to keep a watch upon the trains, to warn the driver in case of any accident or signal from the guard and to keep the axleboxes of all the wheels greased and at night lamps burning properly.

The two sides of the shelter were not both alike because the man gained access to it from the platform side; that is to say, the left-hand side of the tender. He stepped on to the footplate level, then on to the tool box, from there up over the coping of the tender and walked across the back of the tender to his shelter, and to enable him to do this with safety a handrail was fitted. The left-hand side of the shelter is shown in Fig. 16, whilst in Fig. 19 it is shown in back elevation with the handrail and the wooden seat inside the shelter.

This accommodation for the porter was the pattern nearly always used, not only on the 8 ft. single tenders, but on all those others which were attached to passenger trains, but "Lord of the Isles," and a few of her sister engines had a different and somewhat less comfortable form of protection. This will be illustrated in my next article in which will be shown the tenders with iron frames.

(To be continued.)



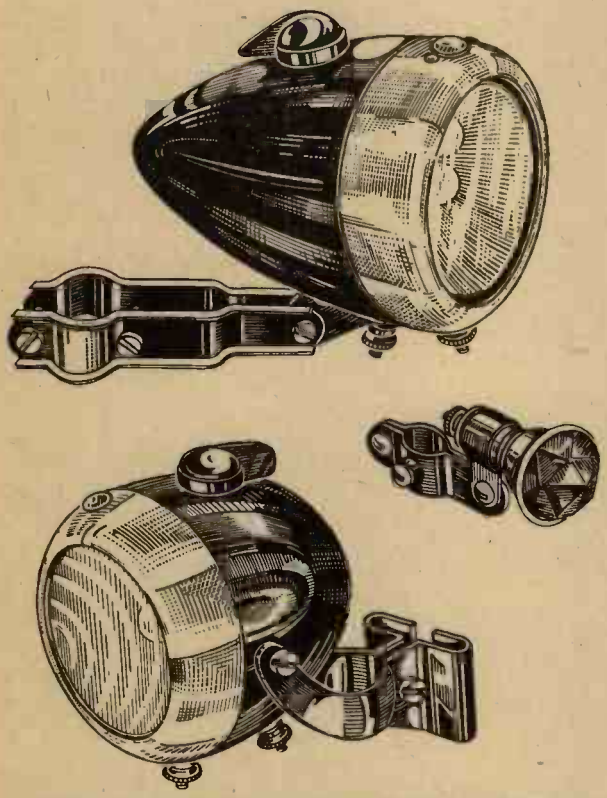


Figs. 18 and 19.—(Left) The fittings on the firebox. (Right) A back elevation of the tender.

Catalogues Received

"Wilco" Products

THE latest catalogue produced by L. Wilkinson, "Electric House," 204 Lower Addiscombe Road, Croydon, introduces among the many electrical devices listed some new designs in electric cycle lamps. Two of the sets (exclusive of dynamos) are shown on this page, the Streamlined Standard Set and the Popular Set.



(Top) This attractive cycle lamp is sold with the Streamlined Standard Set. (Below) The lamp supplied with the Popular Lighting Set. Both lamps work from a 6-volt dynamo.

The Standard Set, which sells at 18*s.* 9*d.* complete, has a black and chromium streamlined headlamp, fitted with twin bulbs controlled by a rotary switch. The 4½-in. chromium front has a special silvered reflector and a red indication light on the top. The lamps of both sets are fitted with thief-proof brackets and are worked from a 6-volt dynamo.

The Popular Set, at 15*s.* 11*d.* complete, is an inexpensive set that will give efficient service and a powerful light at all speeds. The finish of the lamp is similar to that of the previous model, and also has a red indication light at the top of the 4-in. front. Provision is made for a battery in the lamp and the rotary switch enables the bulbs to be used from either the battery or the 6-volt dynamo.

The 6-volt dynamo, which as previously mentioned is standard with both sets, has an output of 0·3 amps., and is chromium plated on brass. The massive collar bearing and two sets of ball-bearings ensures perfect running and long life to all moving parts. The voltage is controlled so that the bulbs will not break when cycling fast, whilst ample current is generated at a walking pace.

Batwin Electric Motors

WE have just received a copy of the latest catalogue issued by Batwin Electric Motors, 138 Southwark Street, London, S.E.1, in which is listed a comprehensive range of their products. Various types of motor are shown, including variable speed reversible motors, D.C. motors, reversible and split-phase motors and condenser motors. Numerous tables are given, including tables of dimensions of Batwin motors.

This firm also manufacture motor-driven controllers utilising mercury tubes for automatically starting motors, and also supply suitable photo-electric cell equipment, being sole distributors of "Cetron" cells.

The Batwin circuit-breaker control switch is remarkably efficient and fully protects the motor and wiring system. As soon as the current rises above a value likely to cause damage, the circuit is automatically broken and cannot be reset whilst the short circuit or overload conditions persist.

Patents and Trade-marks

"THE ever increasing part played by patents and other forms of protection for industrial property makes it most necessary for engineers, manufacturers and others engaged in industry and commerce to have some knowledge of these subjects."

The above extract is from the foreword of the 19th edition of "Patents and Trade Marks," a handbook written by Mr. Benj. T. King, C.I.M.E., and distributed free of charge by King's Patent Agency Ltd., 146A, Queen Victoria Street, London, E.C.4. The aim of this firm is to place the would-be patentee or trade-mark owner in possession of some really useful information. Readers should write for a copy of this interesting booklet.

"The Modern Book of Engineering," by W. H. McCormick. 155 pages. 25 half-tone illustrations. Published by A. and C. Black, Ltd., London. Price 5s. net.

THIS book is one of a series of "Modern" books, and is well produced, and designed to appeal to "youths" of all ages. Throughout, the style is light and interesting, whilst the many illustrations are excellent.

The scope is wide, for the book deals with such diverse engineering subjects as the mass-production of motor-cars, and the construction of the world's famous bridges. Other chapters deal with the building of a steam locomotive, the construction of a modern liner, boring tunnels through mountains, canals and cantilever structures —in addition to a number of other subjects.

"The Craft of Modelling Railways," by Edward Beal. 337 pages. 160 illustrations. Published by Thomas Nelson & Sons, Ltd. Price 10s. 6d.

THIS new book by the well-known miniature railway expert will be found to eclipse all previous publications from the pen of Mr. Beal. Not only does this deal with details of his own miniature (00 gauge) railway system, but it includes many details and illustrations of the model railways operated and built by well-known enthusiasts. The book does not deal exclusively with the 00 gauge, but covers also all other model gauges and devotes quite a large amount of space to the considerations of outdoor model railways. From the primary consideration of the gauge of railway to build for individual requirements, the book takes the enthusiast through all the departments of model railway engineering, from track design and layout through scenic modelling to complete working schedules. There are many details included for the first time of foreign and American layouts and practice, and it is safe to say that no more completely authoritative guide to the subject has ever been published. Some of the details of miniature freight modelling are in themselves of the greatest value to those who already own a model railway.

TRICKS WITH TRAYS AND PLATES

(*Continued from page* 87)

mechanism of various kinds to make possible the working of numerous different tricks.

A useful tray for vanishing cards, coin or other flat objects is easily constructed from any ordinary tray by the method shown in Fig. 12. A piece of thin wood is cut to fit into the tray and occupy half its surface. The centre is then cut from this piece of wood and the opening carried out to the end so that the resulting piece of wood is shaped something like a letter U. This is fastened to the tray and over it is fixed a piece of sheet tin covering half the surface of the tray. The upper surface of the tin is then painted and decorated to match the rest of the tray.

The tray is now fitted with a sort of very shallow tunnel at one end. As long as the tray is held with the opening of this tunnel turned away from the audience the tray appears to be quite ordinary. Yet cards or coins may be vanished by laying them on the low part of the tray and snicking them into the tunnel in the act of seemingly picking them up. With due care not to allow the coins to clink together, several of them could be vanished very effectively by being apparently picked off the tray and thrown into the air.

This piece of apparatus, like many others, is also capable of a reverse action. That is to say it can be used for producing as well as vanishing cards and coins. In this case the things to be produced are hidden at the start in the tunnel and allowed to slide out under cover of a catching movement with the tray, as if the coins were being collected from the air, or under cover of a cloth laid over the tray.

Finally there is another type of tray, or plate in which the tunnel or slide, made to hold a few coins or cards, is fitted under the tray. This is shown in Fig. 13. A piece of thin tin with the edges bent up is soldered or otherwise fixed to the bottom of the tray and afterwards painted black.

QUERIES and ENQUIRIES

A stamped addressed envelope, three penny stamps, and the query coupon from the current issue, which appears on page 123, must be enclosed with every letter containing a query. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL MECHANICS, Geo. Newnes Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

REPAIRING A REFRIGERATOR

"I HAVE one of the early commercial domestic refrigerators which will not freeze. On examination the grub screw on the water control had worked loose, and I imagine the unit got overheated. I have put the water circulation right and the electric heating unit is in working order, but the machine will not freeze nor is there any reduction of temperature at all on the evaporator. I wrote to the manufacturers and their service-man called. I gave him the above facts and he stated that the machine must be burnt out and it would cost £15 for a new unit. I am not prepared to pay this, so I decided to take the unit out of the cabinet. I did this but the boiler, etc., appeared in excellent condition, and on tilting it sideways there seemed to be any amount of liquid refrigerant inside. In an earlier edition of 'Practical Mechanics,' you said there was hydrogen in the evaporator. Could this get lost by overheating? I cannot see where it would escape, and I even put a small blow-lamp on the boiler and tried every welded joint but I could smell nothing. If you could give me any hints (I have a complete workshop) on getting the unit into working order I should be very much obliged." (J. W., Bexhill-on-Sea.)

THERE seems to be little doubt that your refrigerator unit has lost its internal equilibrium as a result of overheating. It is hardly true, however, to state that the unit is "burnt out," and it seems to us that the proposed remedy of replacing the unit by an entirely new one is like equipping a motor car with a new engine simply because a faulty big-end bearing or a broken connecting rod has occurred.

We realise that it would not be a difficult matter for you to open up the refrigerator unit, but even if you did so you would be unlikely to detect anything amiss and, of course, the gaseous refrigerating elements would escape and you would not be able to replace them. Furthermore, the makers of the apparatus would be in a position to say that you had tampered with the unit and so negatived any guarantee which may be attached to it.

We think your best plan is to write to the makers of your refrigerator and to ask whether they cannot repair the unit instead of replacing it. Do not mention applying a blow-lamp to any portion of the unit, for this excessive heat is quite sufficient to upset the internal equilibrium or gas-balance of the unit.

All the makers will have to do will be to open up the unit, recharge it with hydrogen and ammonia and then re-seal it. This is a job which they ought to be able to carry out in their factory to your entire satisfaction but it is one which, we fear, you yourself can hardly hope to tackle.

Mr. W. Simmons has made this attractive speedboat from the constructional details given in the July and August, 1936, issues of "Practical Mechanics."

AN OIL DEPOSIT

"A FRIEND of mine has an idea that he may have oil upon his small estate. He has showed me an oily substance (just like petrol on a wet road) on several ponds and streams in entirely different parts of the grounds. We think that the deposit may be due to marsh gas or something similar.

"I shall be obliged if you can let me know of any simple tests for ascertaining what this oily deposit is.

"There is no possibility of it being left by motor vehicles as none can get near any of the spots where this deposit is seen." (P. F., Crewe.)

YOUR query is an interesting one, but, unfortunately, it cannot, by its very nature, be answered comprehensively in these columns, since to detect the presence of any specific oils in a sample of material necessitates the knowledge and training of a scientific chemist and analyst.

It is not probable that the oily matter you refer to is due to marsh gas or to any other form of natural gas. It may, however, be derived from some shallow ligneous or peaty deposits; whilst, on the other hand, if the land has, at any time in its history, been used for industrial purposes, it is quite possible that the oily matter may have its source in some buried barrel, vat or other container. Petroleum is only found at considerable depths, although, of course, if it were present below the surface of the land, it is quite possible that it might slowly percolate upwards to the surface.

In making tests to ascertain the nature of the oil, you should first observe at what times, seasons and under what climatic conditions it is most noticeable. Is the oily matter blackish or brownish in nature? Has it a fluorescent appearance? What is its odour like? These points are very important ones to observe.

Next, take a quantity of the oily material, dry it as much as possible (without heat) and place it in a bottle. Pour into the bottle a quantity of benzene or petrol and shake the bottle up well, subsequently filtering the benzene or petrol solution of oil into another bottle. Repeat this extraction twice or thrice and then distil off the benzene or petrol. The residue will consist for the most part of the crude oily matter derived from the land.

At this point, we are afraid that the method for its identification becomes almost hopelessly complicated for an ordinary layman to follow, but if, having carried out our advice so far, you obtain a considerable quantity of this oil, you would, no doubt, be able to find a British petrol company who would investigate the matter further for you, or, alternatively, we ourselves would be pleased to express an opinion upon the composition of the oil.

COLOURING CEMENT

1. "IS there any chemical substance which can be added to ordinary grey Portland cement to stain it red? I have tried red ochre, but this is not successful as it seems to wash out when exposed to rain.

2. "Is there a cheap and simple recipe for phosphorescent paint, or is this better bought ready-made? I require it for use on clock hands." (E. N., Hendon.)

1. RED ochre will not stain Portland cement a satisfactory red shade, but if the pigment is of good quality it should not wash out with subsequent weathering. Vermilion, which is a sulphide of mercury, and which can be obtained from paint and

chemical suppliers, is a better pigment to use. It is of a bright red colour and has good "body" and "tinting power." Use as little of the vermilion as possible (or, indeed, of any other pigment) for the colouring of the cement, since the presence of pigments and other foreign matter often affects the setting time and the properties of cement very considerably.

Other pigment reds which could be used for the purpose are chrome red (basic lead chromate), rose pink, Indian red (ferric oxide) and madder lake, all of which are permanent pigments.

2. You can make a luminous paint (of sorts) by calcining oyster shells in a hot fire and then by grinding them up and heating the powder with a quantity of powdered charcoal, but the luminosity of such material is very feeble. For ordinary luminous paint, that containing luminous zinc sulphide is the best.

You should note, however, that all ordinary luminous paints are not permanently luminous; they require to be exposed to the sun's rays periodically in order to regain their luminosity. The only permanent luminous paint is that containing radium-treated zinc sulphide and this alone, in our opinion, is the only one worth bothering about for the purpose you mention. It contains luminous zinc sulphide to which has been added a very small trace of radium barium bromide, the whole being ground up with transparent varnish. You cannot possibly make this material yourself, but it can be obtained from chemical supply firms (at necessarily rather high cost), as, for instance, Messrs. Harrington Bros., Ltd., City Road, London, E.C.1, or from many of the concerns dealing in clock and watchmakers' sundries. Messrs. Johnson, Matthay, Ltd., of Hatton Garden, London, E.C., also supply radium-containing luminous paints in small quantities.

COPPER PLATING

1. "CAN you give me the names of the ingredients required in a copper-plating solution, to copper-plate tinplate or steel, and the electrical pressure required and the amount of electricity?

2. "A tin-plated article was submerged in a solution of copper sulphate ($CuSO_4$), after being left there for about 10 minutes the film of tin was found to have been replaced by copper; the film however was very delicate and moved at the slightest touch. The article was dried and polished and the copper film appeared to have dried on the steel base and was immovable except by mechanical means (scratching) the article was polished up and appears to have been to all intents and purposes copper-plated though no electrical current went through the solution while the article was in it. Could you give me an explanation of this and could you tell me if such a process is practical or was the foregoing action a fluke?

3. "I have a piece of embossing in tinplate (an embossed lid). It originally had printing ink on it to represent a copper oxidised design, i.e. the high parts were copper lacquer to represent copper and the crevices, etc., in the embossing were black to represent copper oxide. Having succeeded in getting all the copper lacquer off I want to copper-plate it (question one), and having copper-plated it, am going to put it in an electrolytic cell as the positive anode. On passing current through the cell H_2 comes off the cathode and O_2 off the anode, but the anode being copper the copper oxidises and my lid will take on a thin film of oxide. I then propose polishing the oxide off the high spots and it would give the effect of oxidised copper finish. Is this practical?" (H. B., Liverpool.)

1. A TEN PER CENT. solution of copper sulphate slightly acidified by the addition of a few drops of sulphuric acid or made alkaline by the addition of ammonia until the blue precipitate formed dissolves with the production of an intense violet-blue solution will copper-plate small steel and tinned-iron articles satisfactorily at an E.M.F. of 4–6 volts. A copper anode should be used, the articles to be plated comprising the cathode. The temperature of the solution should be between 65° F. and 85° F., and the solution should be stirred more or less continuously. Plating may continue for from ten to twenty minutes, after which the articles should be rinsed and dried in hot sawdust or bran.

A still better plating bath contains a mixture of copper sulphate and potassium cyanide, but since not only is the latter substance extremely poisonous but, also, the deadly gas, cyanogen, is likely to be evolved in the preparation of the bath, we certainly do not recommend you to experiment with it. For all amateur work, the acid or alkaline copper sulphate plating bath will be found quite satisfactory.

2. The non-electrical coppering of the tin-plated article which you describe is quite a well-known action, since many metals have the power of displacing copper from its solutions and depositing that metal on their surfaces. The process, however, is not a practical one. The non-electrically deposited copper does not "hold" on to the metal surface well. It is deposited in a friable or powdery condition and it usually disintegrates rapidly.

3. The process which you propose to work would hardly be practicable, for, if the deposited copper oxidised at all, it would tend to oxidise to the red oxide of copper—cuprous oxide, Cu_2O.

A better way of bringing about the desired result is to copper-plate the article in the manner in which you describe, and then paint the high spots (which are to remain untarnished) with a thin coating of a transparent varnish, as, for instance, celluloid varnish (prepared by dissolving scrap celluloid in acetone). The entire article is then immersed in a very weak solution of sodium or ammonium sulphide. Immediately, the unprotected copper plating will assume a golden yellow coloration which will quickly darken until it becomes black. When the desired coloration has been attained, the article is withdrawn from the sulphide bath, thoroughly well washed and dried. Finally, the varnish is removed by rubbing it over with a rag saturated with some varnish-solvent, as, for instance, acetone. In this manner you will succeed in getting the effect you require.

DECORATING PARCHMENT

"CAN you please tell me how to obtain a cracked, egg-shell effect on parchment lampshades? I think it is done with varnish, but my experiments have so far failed." (A. R., Peckham.)

YOU can obtain the finish you require on lampshades by dissolving scrap celluloid (old photographic films, for instance, after the gelatine coating on both sides has been cleaned off) in acetone, and by mixing with this solution a solution of gum dammar in benzene. Alternatively, you may obtain the effect by dissolving in an acetone solution of celluloid either camphor, naphthalene or Abrac Ester Gum, the latter

material being obtainable from Messrs. A. Boake, Roberts Ltd., Stratford, London, E.

The acetone solution of celluloid should be of the consistency of thin varnish, but you will have to gauge yourself the exact proportion of the other ingredient which you add to it. A small proportion of this latter will give a fine egg-shell effect, the effect coarsening as the proportion of the latter ingredient is increased.

On the commercial scale, these "egg-shell" effects are often obtained by means of bakelite varnishes which are heated until they become brittle and crack.

NAMES ON CELLULOID

"WE should be glad to have your advice on the following matter:

"Amongst the receivers which we import from Germany is one fitted with a celluloid dial, from which the names of three important stations are missing. It would be as well to explain that the process used in the original dial is a black backing with transparent station name markings, illuminated from behind.

"We are now faced with the problem of adding the names of missing stations to the dial. Can you suggest any method of printing or stamping these names on the front of the dial or would it be possible to remove the black backing from the celluloid in such a way that these new names could be made to show transparently? We may add that there is ample room for the three new names. If at all possible we would prefer to stamp these three station names on the front of the dial with some white substance.

"Should you be able to offer any suggestions re the above we should be very grateful and we shall be still further convinced of the usefulness of your magazine." (Radio Telefunken Ltd., Dublin.)

YOU have omitted to mention whether the lettering on the celluloid dials is surface-printed or whether it is actually embossed (stamped) on the dials. We are inclined to suppose that you will find it to be slightly embossed, in which case you can add further lettering to the dials by having a metal stamp made, and by using this to emboss the dials with. In preparation for this, the dials should be dismantled and soaked for a few minutes in warm (not hot) water in order to render the celluloid soft. The dial is withdrawn from the water, quickly wiped dry, placed upon a perfectly hard and level surface (as, for instance, a sheet of ½-in. plate-glass), and the additional lettering is carefully stamped on it by means of your own metal stamps.

The black backing from the dials is easily removable by wiping over it a soft rag saturated with acetone or with a mixture of equal parts of acetone and amyl acetate, and it may be replaced by painting over the back of the dial with a solution of celluloid in equal parts of acetone and amyl acetate to which a little acetone-soluble black aniline dye has been added. Such a dye can be obtained from Messrs. A. Boake, Roberts, Ltd., Stratford, London, E. Alternatively, lamp-black can be added to the celluloid solution to colour it black.

Having stamped the additional names on the dial, it will be an easy matter for you to fill the lettering with some white substance if you so desire. Make up a thick solution of celluloid in a mixture of amyl acetate and acetone and incorporate with it a quantity of the finest zinc white, talcum, or any other fine white pigment obtainable. The result will be a white semi-paste, which must be kept tightly corked to prevent it hardening. Take up a little of this upon a soft rag and quickly wipe it across the embossed lettering. It will fill up the lettering and, when dry, will remain firmly in position and will not tend to flake away.

You should, of course, conduct a few trials with these operations upon a sheet of scrap celluloid in order to acquire the necessary skill before you commence the alteration of the radio receiver dials.

A LOCAL ANÆSTHETIC

1. "CAN you tell me the name of a chemical or drug which I can use as a local anæsthetic?

2. "How long is the drug effective and where can I buy same?

3. "When are you going to publish the details of the Midget aero engine, about 4 c.c., which you mentioned in your magazine some months ago?" (B. K., Leytonstone.)

1. YOU do not state exactly the purpose for which you wish to employ a local anæsthetic, and we are therefore unable to give you a very specialised reply, since various types of local anæsthetics are applied for different uses.

2. A good all-round local anæsthetic is novacaine, which may be obtained from dental supply firms, as, for example, the British Dental Supply & Mfg. Co., 86 Rosebery Avenue, London, E.C.1. You may find difficulty in obtaining a supply of this substance unless you are able to produce evidence of being competent to use it for a good purpose.

The duration of anæsthesia produced by a local anæsthetic depends upon the nature and amount of the anæsthetic injected, the method and site of injection and, to a certain extent, upon the individual treated. Six minutes is a reasonable duration of complete anæsthesia to expect from the injection of a small dose of local anæsthetic into a superficial area of the body.

3. Details of the Midget Aero Engine will be published at a later date.

EXPERIMENTING WITH REFRIGERATION

"I AM desirous of experimenting with 'non-compression' (absorption type) refrigeration and shall be glad if you will give me some information on the following points.

1. "Assuming the evaporator is to measure 12 × 9 × 6 in., what will be the minimum dimensions for the boiler and absorber?

2. "Can the ammonia solution be of *any* specific gravity?

3. "What volume of hydrogen will be required for a unit of the above dimensions?

4. "Does this method of refrigeration entail very high pressures; does the efficiency vary with the pressure?

5. "Is air-cooling of the condenser sufficient under ordinary room conditions?

6. "Apart from some means of thermostatic control, what regulating valves are required?

7. "I do not know whether I shall be able to construct an experimental unit, but if the pressures are not too high, I might be able to utilise some metal containers I have on hand. Perhaps you could give me some idea of what gauge the materials should be." (R. B., Plymouth.)

1. IN a refrigerator of the absorption type, the necessary relative dimensions of the evaporator, absorber, and boiler depend entirely upon the design of the apparatus and the internal pressures under which it works. Thus, no hard and fast rule can be applied. You will find, however, that it will be best to have the evaporator about a third larger in size than the absorber, the boiler being some two-thirds smaller.

2. The ammonia solution used in commercial absorption refrigerators comprise a strong solution of ammonia gas in *distilled* water, the strength being somewhat greater than that of the ordinary commercial "liquid ammonia."

3. Here again, it is impossible to lay down any definite rule respecting the amount of hydrogen required. The quantity of this gas all depends upon the design of the refrigerator and the pressure at which it is contained therein. Some refrigerators work as low hydrogen pressures; others operate at considerable pressures.

4. Usually, a fairly high hydrogen pressure gives stronger cooling, but the tendency nowadays is to produce household refrigeration apparatus working at almost atmospheric pressure.

5. An absorption refrigerator may be either air- or water-cooled. Air-cooling is sufficient under ordinary conditions, but water-cooling gives better refrigeration, although, of course, it introduces complications of design.

6. In absorption refrigerators, no regulating valves are required, since the hydrogen atmosphere in the evaporator results in the ammonia evaporating and maintaining a constant pressure within the apparatus, thus requiring no checks or valves of any description. As the ammonia evaporates into the hydrogen, the hydrogen-ammonia mixture sinks to the bottom of the evaporator and passes through the gas heat-exchanger and into the absorber.

7. Galvanised sheeting of gauges between $\frac{1}{32}$-in. and $\frac{1}{8}$-in. thickness are generally used in commercial refrigerator construction, the seams being oxy-acetylene welded (not soldered).

Before proceeding with the task, we would strongly advise you to study one or two technical works upon refrigeration and refrigerator construction.

MODEL AERO TOPICS

(*Continued from page* 100)

Power-driven Models

THE F.A.I. passed the following rule for power-driven models: No engine may exceed 10 c.c. and the maximum wing loading of the models to be fifty grammes per square centimetre. Dr. Thurston has been made Chairman of the Model Section of the F.A.I. for the ensuing year.

Records

AN application for a seaplane record by Mr. R. Smith, of North Kent, with a duration of 2 mins. 28·75 secs. was passed.

Mr. L. V. Mawby, of the Ealing Club, claimed a catapult-launched glider record of 3 mins. 1 sec. This record was passed.

Mr. C. W. Needham, of Bristol, claimed a Biplane record with a duration of 1 min. 56·1 secs. This was also granted.

An application from Mr. R. T. Howse, of Bristol, for an R.O.G. record of 12 mins. 4 secs. made during the Wakefield Elimination Trials was passed.

Results of the Sir John Shelley Cup

			Points
1st	C. R. Jefferies	Birmingham	57
2nd	R. J. Trevithick	T.M.A.C.	53
3rd	J. C. Gardner	Banbury	48½
4th	F. Harris	Woking	47½
5th	J. Cohen	Brighton	46
6th	W. Rushen	Leytonstone	45
7th	G. Rickard	Bournemouth	44
8th	A. E. Brooks	Bournemouth	42½
9th	F. E. Nugent	Bournemouth	41
10th	L. S. Wigdor	Wembley	38½
11th	A. D. Paine	Bournemouth	36
12th	H. L. Sharwell	Wembley	23
13th	A. E. Ross	Northern Hts.	16
14th	E. G. Penhall	Bournemouth	10
15th	E. H. Keil	Leytonstone	9½

The Bowden International Trophy

THE first competition for this trophy called forward 24 entries, including 2 French and 2 Americans, and resulted in a tie for four competitors. H. R. Fish (U.S.A.), F. E. Nugent, J. C. Gardner, and J. S. Collyer, of Great Britain, each scored 90 points.

In the refly, Collyer and Nugent landed outside the aerodrome. J. C. Gardner lost points for damaging his undercarriage after flying 60 seconds. H. R. Fish flew 57·4 seconds and landed well.

The final placing was :

		Points
H. R. Fish	U.S.A.	150
J. C. Gardner	Great Britain	120
J. S. Collyer	,, ,,	90
F. E. Nugent	,, ,,	90

National Cup, 1937

		Average
H. Simmons	Blackheath	
E. Chasteneuf	—	
S. R. Crow	—	115·63 secs.
R. F. Hook	—	
G. J. Liggett	T.M.A.C.	
J. Worden	—	
T. Shurrock	—	86·98 secs.
A. A. Judge	—	
F. Almond	North Kent	
E. A. Davies	—	
R. Smith	—	79·420 secs.
T. Wickens	—	

The Normac Catalogue and Handbook

I HAVE received from the Northern Model Aircraft Co., 37a Fountain Street, Manchester 2, their catalogue and handbook, which costs 4*d.* by post. It includes some interesting hints and tips on the design and construction of model aircraft, with special regard to models of the Wakefield Cup type. The catalogue lists graded balsa wood, in strip, sheet, and block, L sections, T sections, leading edging, hollow spars, trailing edges, silver spruce, and birch, wheels of all types, bolts, screws, gears, tubes, wall thrusts, cup washers, jap tissues and silk, dope, varnish, aniline dye powders, elastic, lubricant, airscrews, kits, etc., etc.

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SUPER A.C. MOTORS. Brand New, 1/6 h.p., 26/-; ¼ h.p., 40/-; ½ h.p., 65/-; larger sizes. Electric Tools, Machines, Pumps, Compressors, etc.—John P. Steel, Clyde Street Mills, Bingley.

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MODEL parts machined. Light Engineering Repairs. Estimates free.—LEWIS GATENBY, Engineer, 17 Thornton Lodge Road, Huddersfield.

ENGINES

"BANTAM" 6 c.c. O.H.V. Petrol Motor Castings, 13/6, set posted include Diecast Head, Piston, Conrod. Blueprint with Machining Details, 3/1, posted. "A.C." Plugs ⅜" dia., 42, 4-volt accumulators. 5/6. LIST STAMP. Castings, blueprints, machined parts, materials, 1½" scale TRACTION ENGINE, 1" scale Jib Crane. Either list 3d.—A. J. EVERY, MANUFACTURING, MODEL, GENERAL ENGINEERS, 27 Elder Place, Brighton.

DON'T MISS THIS! 98-c.c. 2-stroke engines suitable for Motor Boats, driving machinery, etc., etc., complete with magneto, listed at £9 10s. 0d.; 55/-. George Grose, Ludgate Circus, E.C.4.

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THE MICROSCOPE. The British Journal of Microscopy and Photomicrography, 1s. monthly. Al, Newsagents, or 1s. 1d., post free, from The Micro scope 20/21 Took's Court, London, E.C.4.

MISCELLANEOUS

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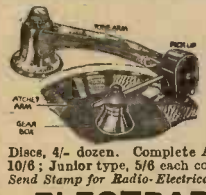

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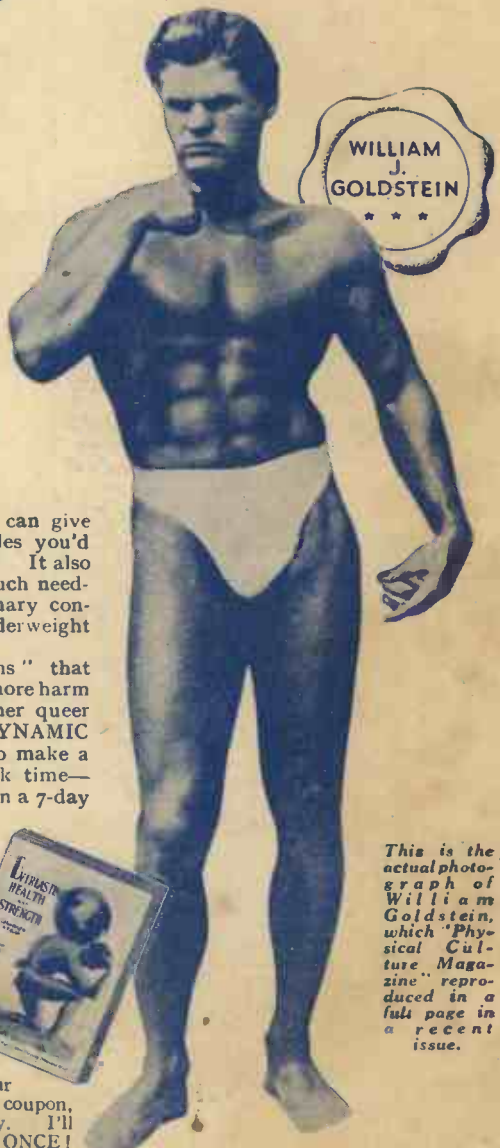

This is the actual photograph of William Goldstein, which "Physical Culture Magazine" reproduced in a full page in a recent issue.

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